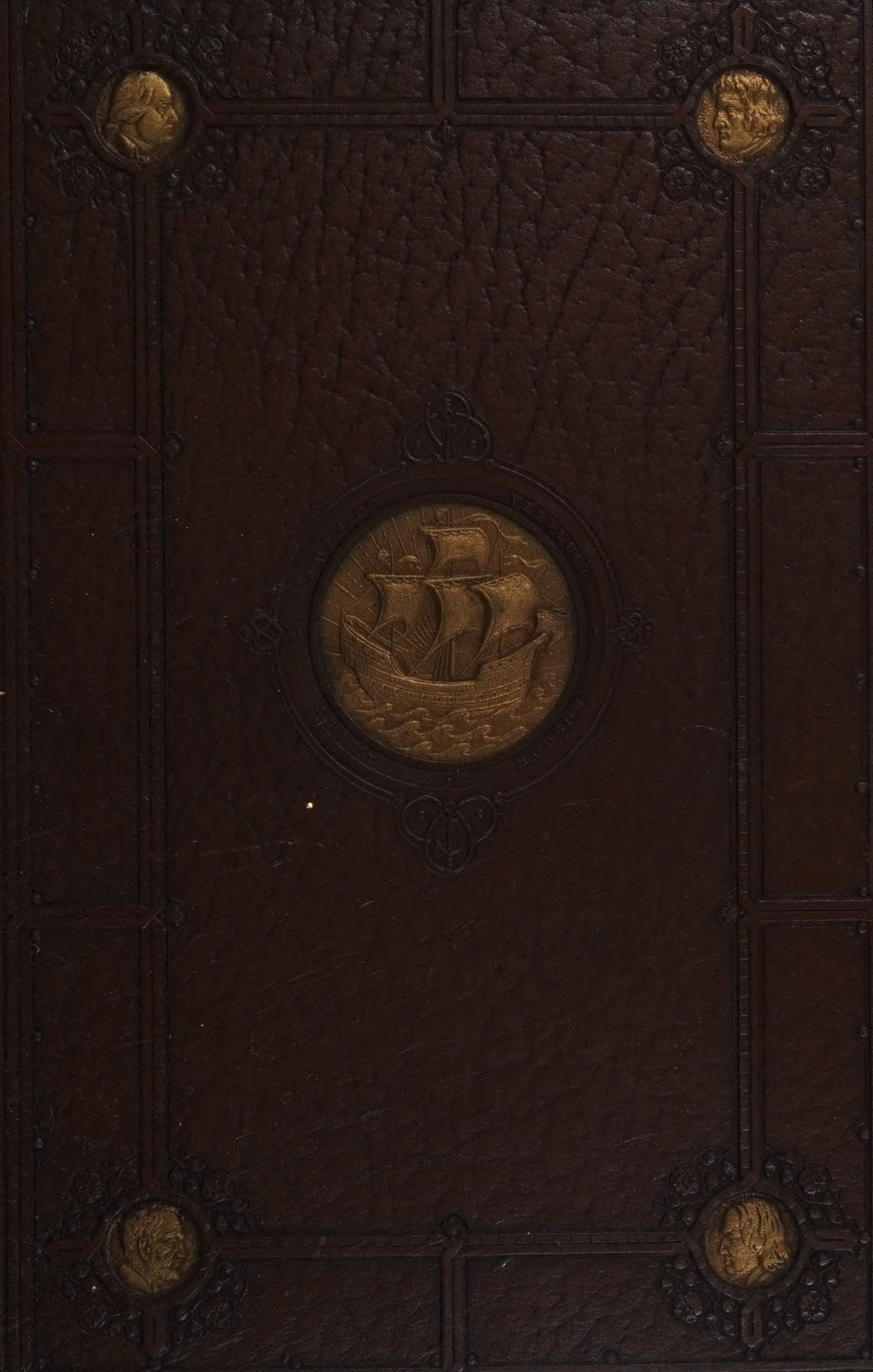


Property of
H. A. Barrington

H. A. BARRINGTON
SANTA CRUZ, CAL.

The BOOK *of* KNOWLEDGE

The Children's Encyclopedia

EDITORS-IN-CHIEF

HOLLAND THOMPSON, Ph.D.

The College of the City of New York

ARTHUR MEE

Temple Chambers, London

WITH AN INTRODUCTION BY

JOHN H. FINLEY, LL.D.

Late President of the College of the City of New York
and Commissioner of Education State of New York

DEPARTMENTS

The Earth
Stories and Legends
All Countries
Golden Deeds
Helps to Learning
Literature
Animal Life
Famous Books
Dominion of Canada
The United States
Familiar Things
Our Own Life
The Fine Arts
Men and Women
Poetry and Rhymes
Plant Life
Things to Make
and Things to Do
Book of Wonder

VOLUME XVII

New York

THE GROLIER SOCIETY

LONDON: THE EDUCATIONAL BOOK COMPANY

Copyright, 1926, 1927 by
THE GROLIER SOCIETY
Copyright 1923, 1924, 1925, 1926, 1927 by
The Amalgamated Press (1922) Limited

In addition to the poems and pictures to which copyright notices are separately appended, and to the material herein copyrighted as above, the following articles are further protected by copyrights as follows: Copyright, 1908, by The Amalgamated Press, Limited: The First Apple Dumpling; A Tale of Christmas Eve; John Maynard, Pilot; The Picture of a Golden Deed; Indian Legends; Legends of Places in England. Printed in U. S. A.

A (17)

CONTENTS OF THIS VOLUME

This is a short guide to the principal contents of this volume. It is not possible to give all of the questions in The Book of Wonder, or the titles of all of the Little Verses and Problems, but in all cases the pages are given where such sections of the book begin. In the big Index, Volume 20, you will find every title and every subject, including the pictures.

PAGE

THE BOOK OF THE EARTH
- Where Color Comes from . . 6079
- The Waves of Sound . . . 6313

THE BOOK OF PLANT LIFE
- Flowers of the Poets . . . 6123
- Flowers of the East: I . . . 6273

THE BOOK OF ANIMAL LIFE
- The Mighty Insect 6063
- Bees and Wasps 6221
- The Wonderful Ant . . . 6349
- Mosquitoes and Flies . . . 6417

THE BOOK OF OUR OWN LIFE
- The Distribution of Wealth . . 6691
- Spending and Saving . . . 6359

THE BOOK OF WONDER
- Why can baby animals walk so soon? . 6173
- Why does milk turn sour? . . 6174
- Why do we sleep? 6175
- What makes us sneeze? . . . 6176
- Why is Boston called the "Hub of the Universe"? 6177
- Why does a stick float? . . . 6178
- Do we see ourselves in dreams? . 6179
- Why should we have state or national flowers? 6180
- How did London begin? . . . 6283
- What makes a whirlpool? . . . 6284
- Why does a face in a mirror seem crooked? 6285
- What is the Nobel Prize? . . . 6288
- What is daylight-saving? . . . 6289
- Could people live without rain? . . 6290

THE BOOK OF FAMILIAR THINGS
- How We Send a Telegram . . 6049
- The Wonder of the Telephone . . 6183
- The Wonder of Radio . . . 6363

THE BOOK OF LITERATURE
- The Literature of Italy . . . 6149
- The Literature of Germany: I . . 6265
- The Literature of Germany: II . . 6409

PAGE

THE STORY OF THE FINE ARTS
- The Golden Years in Europe . . 6155
- The Renaissance in Italy . . . 6297

THE BOOK OF ALL COUNTRIES
- Among the Snow-capped Alps . . 6083
- Austria's Rise and Fall . . . 6191
- The Stories of Hungary, Czecho-Slovakia and Jugo-Slavia . . . 6339

THE BOOK OF THE UNITED STATES
- The North Central States: II . . 6037
- What One May See in New York . 6207
- The Lost Colony of Roanoke . . 6333

THE BOOK OF MEN AND WOMEN
- A Modern Wizard 6133
- The Makers of Telegraphs, Telephones and Wireless . . . 6235
- Naval Heroes of Young America . 6325
- Conquerors of the Sea . . . 6397

FAMOUS BOOKS
- The Old Man Named Scrooge . . 6115

THE BOOK OF GOLDEN DEEDS
- John Maynard, Pilot . . . 6137
- A Poacher's Silence . . . 6138
- The Man Who Carried Death . . 6139
- The Picture of a Golden Deed . . 6140
- Heroes of Aviation . . . 6291
- The Man Who Thought of His Comrades 6294
- How Lady Godiva Helped Her People 6295
- Two Poet-soldiers 6393
- The Hero of Kavala . . . 6395
- Edith Cavell 6396

THE BOOK OF STORIES
- The First Apple Dumpling . . 6095
- The Ugly Duckling 6096
- A Tale of Christmas Eve . . . 6098
- Catching a Thief 6099
- The True Story of Father Christmas . 6102
- Indian Legends 6199
- Hop-o'-my-Thumb 6317
- Geraint and Enid 6320
- The Dog and the Wolf . . . 6323
- Legends of Places in England . . 6324

PAGE

THE BOOK OF POETRY

God Rest You Merry, Gentlemen . 6105
Old Christmas 6106
Christians, Awake! 6106
Christmas Morning 6107
A Hymn on the Nativity of My Saviour 6107
Little Children, Wake and Listen . 6108
Jealous Jack Frost 6108
Once in Royal David's City . . 6108
The Birth of Christ 6108
Ring Out, Wild Bells . . . 6109
Death of the Old Year . . . 6109
I Saw Three Ships 6110
He Comes in the Night . . . 6111
Dame, Get Up and Bake Your Pies . 6112
Merry Are the Bells . . . 6113
The Star-Spangled Banner . . 6249
Columbia, the Gem of the Ocean . 6250
Yankee Doodle 6250
Dixie 6250
My Country, 'Tis of Thee . . 6251
Battle-hymn of the Republic . . 6251
America, the Beautiful . . . 6251
Patriotic Songs of Other Lands 6251–6256
O Canada 6256
Chant National 6256
Hear, O Ye Nations . . . 6256
The Norman Baron . . . 6375
The Author's Resolution in a Sonnet 6376
Orsames' Song 6376
To Lucasta, on Going to the Wars . 6376
Night 6376
The Lay of the Last Minstrel . . 6377
On His Blindness 6378
The Reconciliation 6378
Old Friends 6378
Believe Me, If All Those Endearing Young Charms 6378
Light 6378
Hiawatha's Brothers . . . 6378
Winter 6378
To a Waterfowl 6379
A Ternarie of Littles . . . 6379
Babyland 6379
Unkindness 6379
Say Not, the Struggle Naught Availeth 6380
Little White Lily 6380
The Industry of Animals . . . 6380
Auld Lang Syne 6380
Little Verses . . . 6110, 6381–6384

THINGS TO MAKE AND THINGS TO DO

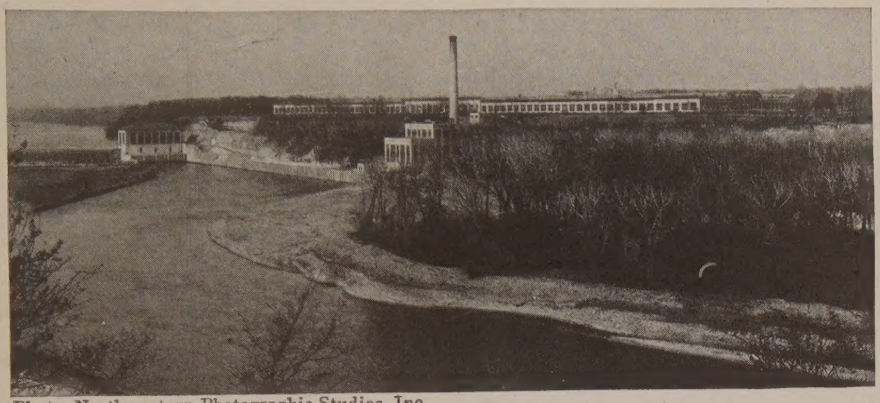
America's National Game . . 6141
A fancy-dress tea-party . . . 6144
A box that draws voice pictures . 6145
Measuring the height of a tree . . 6145
How to house several birds at once . 6146
First Aid
What to do in cases of drowning . 6147
Games to play on the beach . . 6257
Can you find your way into this maze? 6258
How to make a concrete dog-house . 6259
How to prevent static in your radio . 6260
How to draw thousands of faces . 6261
Convenient workbench devices . . 6262
Making and using a pair of stilts . 6263
The meaning of Hallowe'en . . 6263
A card that helps us to make designs . 6264
How to know the rocks . . . 6385
A button made from a shoe-lace . 6386
Musical instruments from old bottles . 6387
A dainty muslin window-curtain . 6387
Twenty-five ways of saying the same thing 6388
Games to play with marbles . . 6389
Making spinning pictures . . . 6390
Hints and tricks for odd moments . 6391
How to make a history notebook . 6392

FRENCH

Little Picture-Stories . 6090, 6312, 6374

COLORED PLATES

Flowers and Their Visitors . 6073–6076
The True Story of Father Christmas 6102–6104
Christmas Songs 6105–6113
The Old Man Named Scrooge . . 6115
Buildings of Europe's Golden Age 6165–6172
Great Buildings of Italy . . 6301–6308
One, Two, Buckle My Shoe . . 6381
The Fox and His Wife . . . 6382



Photo, Northwestern Photographic Studios, Inc.
The Plant of the Ford Motor Company at St. Paul, Minnesota.

THE NORTH CENTRAL STATES

PART II

CONTINUED FROM 5996

IN the first story of the North Central states we told you of the people and of the agriculture and the forests of the region. Now we come to the mines, the manufactures and the means of transportation, all of importance.

Connect Chicago and Buffalo, Buffalo and Pittsburgh, Pittsburgh and Chicago with straight lines. In this triangle is produced the larger part of the iron and steel of the United States. There are blast furnaces for reducing iron-ore in Chicago, Gary, Cleveland and Youngstown. Yet there is practically no iron-ore and but little coal in this triangle. Why is this area so important in the production of iron and steel?

At one time, when the white settlers were between the Appalachian Highlands and the Atlantic seaboard, bog ore was taken from the swamps along the coast, and charcoal was used to melt the iron-ore. Later the hard coal of Pennsylvania was used, and blast furnaces were erected in eastern Pennsylvania. Still later it was found that the soft coal of western Pennsylvania could be made into coke that would be used to reduce iron-ore, and the industry became very important in Pittsburgh and near-by cities.

Soon the ore near Pittsburgh began to fail, and it looked as if the iron-and-steel industry would decline. But over one thousand miles away, in Minnesota, rich ore deposits were discovered in a region where no coal was available for reducing the ore. The ore could easily be mined, and in places open-pit mining was possible. Some plan was necessary to bring ore and coal together, but the railroads could not be used, as the freight was too high.

A glance at a map will show that there is a great system of fresh-water lakes that extends from within about one hundred miles of the ore fields to within about one hundred miles of Pittsburgh. These lakes are large and deep, and the only barrier is between Lake Superior and Lake Huron at the falls of the St. Mary's River. This barrier was overcome by a canal. Long, narrow boats that could hold several thousand tons of ore were built. Railroads bring the loaded ore cars from the pits and mines to Duluth and other lake ports. The ore is taken to the southern shore of Lake Erie and unloaded at Cleveland and other ports. Then some is taken to Pittsburgh.

Why was the ore taken to the coal rather than the coal to the ore? About two tons of coal were necessary to reduce one ton of iron-ore, and a ton of iron-ore also takes less room than a ton of coal. Then, too, when the iron-ore was taken east it was on its way to market, as the heavy demand for iron and steel was in the East. In the story of Iron and Steel beginning on page 1935 we show you the whole process.

But Pittsburgh has begun to worry about its leadership in the iron-and-steel industry. Cities on the lakes have erected blast furnaces. Chicago, Gary and Cleveland secure ore from the lake boats, and the railroads bring in coal from the south. In 1906 a sand-dune area at the southern end of Lake Michigan was bought by the United States Steel Corporation, an artificial harbor was constructed, blast furnaces were erected, coke ovens were built, and a new iron-and-steel city, Gary, Indiana, was established.

There is a break in transportation where the ore is taken from the lake boats and loaded upon cars. This transfer of ore, plus the rail haul, is expensive. At the present time less than a ton of coal is required to reduce a ton of iron-ore. The lake cities need gas, which is made by heating coal in ovens. (See page 635 for the process.) When the gas is driven out of the coal, coke is left. There is a market for the gas in the lake cities, and the coke can be used in the blast furnaces. The lake cities also have the double advantage of transportation by water and by rail.

Some people believe that Duluth will become a great iron-and-steel centre. Their dreams may come true. Coal can be brought back in the ore boats at a low freight rate. Will the market for the iron and steel of Duluth be in the East? Probably not. The region to the west of Duluth has been rapidly settled, and Duluth's iron and steel will move westward.

St. Louis once had many blast furnaces. Ore was brought from Pilot Knob and Iron Mountain, a hundred miles away in the Ozarks. As late as 1880 St. Louis was spoken of as the "City of the Iron Crown." When the rich deposits of the Ozarks were exhausted the industry declined. Recently Roberts' coke oven, which makes excellent coke out of Illinois coal, has been invented. Across the Mississippi River from St. Louis coke ovens and blast furnaces have been erected. Ore can be secured either from Minnesota or from the rich deposits of Alabama, and a plan is under way to bring the Minnesota ore by way of the Mississippi River. The market for the product will be chiefly in the South and the Southwest. St. Louis may again become the "City of the Iron Crown."

How Michigan became important in the production of copper

Pieces of copper supposed to have been left by a glacier have been found on the prairies of Iowa and Illinois. Veins of copper in a pure state were finally found on the surface in the peninsula that extends into Lake Superior. Pure copper will bend but will not break. The Indians had chipped off as much of the copper as they could, and the exposed parts were as smooth as a floor. Strange as it may seem, pure copper is more difficult to mine than when mixed with other materials. Ordinary charges of dynamite had little effect on it: extremely heavy charges were necessary.

A man organized a company and went into the forests where no copper was exposed, bought some land, and dug a shaft. He had noticed that the vein that was being worked dipped at a certain angle. He then estimated the depth below the surface at which this vein extended under the land that he purchased, and found copper as he had expected. Some mines now extend a mile beneath the surface. Michigan, once the leading state in the production of copper, has been passed by Arizona and Montana.

How Missouri became important in lead and zinc

When the French came to the Mississippi Basin they found lead-ore in the soil and subsoil of the eastern margin of the Ozark Upland of Missouri. The American settlers also built furnaces and secured lead from these deposits; but most of the lead-ore was finally removed and the industry declined. A shaft sunk into the solid rock showed that the rock itself was rich in flakes of lead. To-day the largest lead company in America has its mines in the eastern margin of the Ozarks, and the industry has helped St. Louis to be a prosperous city.

About the same time that the Forty-

PICTURES FROM FOUR STATES

Photo, courtesy Salina Chamber of Commerce.

Kansas usually leads in the production of wheat, and here are four large flour mills in Salina.

Minnesota produces over half of the iron-ore of the United States. It generally lies near the surface, and the Pennington is the largest open-pit mine in the world. Photo, Hibbard Studio.

The factories in Cincinnati, Ohio, where Ivory Soap is made. Photo, courtesy Chamber of Commerce.

The American Smelting and Refining Company at Omaha, Nebraska. Photo, Ewing Galloway.

niners were rushing to California to seek gold, a smaller group of men went to the newly discovered lead district of southwest Missouri. These lead deposits were soon exhausted, and no one paid any attention to the zinc-ore. Soon new methods of reducing zinc-ore were devised, new deposits were discovered, and towns which had begun to decline took on a new lease of life. The Joplin district to-day produces much zinc, although the more important mines that have been recently opened are in adjoining states.

How Michigan Mines Salt Without Sinking Shafts

Salt is a common article in every home. The oceans have large quantities of salt in solution, and salt water can be evaporated, leaving the salt in the pan. We might suppose, therefore, that the salt on the table comes from the ocean, but Michigan is the leading state in the production of salt, and Michigan is far from the ocean. Where, then, does Michigan get its salt?

Long ago much of what is now Michigan was under water, which was an arm of the ocean—a great gulf. The region had less rainfall than it has to-day, and as the water evaporated, more came in from the ocean. Gradually much salt was deposited on the bed of the gulf. Afterward the salt-beds were covered up with large quantities of sand and mud which became rock. The salt-beds deep in the ground are the sources of Michigan's salt.

When coal is mined a shaft is sunk into the ground to the vein of coal. Some salt is also mined in this way. But man has been able to get the salt far beneath the ground without sinking shafts. He drills a hole down to the salt-beds and drives in two pipes. Hot water is forced through one of the pipes, and takes the salt in solution. More water is forced through the pipe, and the hot salty water is forced out of the second pipe. The salty water is then evaporated, and the salt is left in the pans as a solid.

How the Coal of the North Central States Is Mined

The southern part of this group of states is better supplied with coal than the northern part. A coal-field extends from the central part of Iowa through the northern and western part of Missouri into Kansas. Another coal-field lies in the lower peninsula of Michigan. But the most valuable coal-field is the Illinois-Indiana-Kentucky coal-field. There are many mining towns in southern Illinois. In most places the coal is deeply buried beneath the surface. Hillside mining and pit mining, therefore, are not very important. Most of the coal is secured by shaft mining. A shaft is sunk to the coal vein, and long tunnels are formed underground. Read the story of Coal beginning on page 785.

Some years ago an important petroleum field was opened in eastern Illinois, which became the leading state of this group in petroleum. While petroleum is still secured from this field, the production has declined, and Kansas has become the leading state in the group. You will recall that Oklahoma and California are the leading states in the production of petroleum. The Oklahoma oil-field extends northward into Kansas.

When petroleum is found people become excited, as there is a possibility of becoming rich in a short time. The surface rights to oil that may be beneath sell for a high price, and people spend money freely. But the underground pool of oil is limited. When the pool is exhausted, unless the people have found other sources of wealth, the community declines. Many people in eastern Illinois had struggled for years to make a living on poor land. When petroleum was found they were able to satisfy their longings.

Why the Mississippi Carries Less Commerce Than Formerly

Commerce on the Great Lakes has become enormous. Commerce on the Mississippi River has come to be of less importance. There are several reasons. The railroads have been built with few curves from one important commercial centre to another. The winding pathway of the river increases the distance from one river port to another. Railroads can operate throughout the year. The Mississippi, especially above St. Louis, is closed to navigation for a part of the winter season. During the latter part of the summer season the water may be too low for the larger boats and barges, and the channel also shifts, and snags form.

Railroad stations can be built where needed, but the construction of modern piers is very expensive. The equipment

DETROIT, THE MOTOR CITY

Though this site was visited by white men as early as 1648, the first settlement was made in 1701 by Sieur de la Mothe Cadillac, who built Fort Pontchartrain. This is a part of the sky-line from the river.

This view from the air shows part of the modern city, the Detroit River and Canadian territory beyond. Detroit is now the fourth city in size in the Union and is growing with marvelous rapidity.

This pictures another section of the waterfront. Though the city produces 85 per cent of the passenger motor cars in the United States, it has many other important industries as well.

Photos, Manning Bros., courtesy Detroit Convention and Tourists' Bureau.

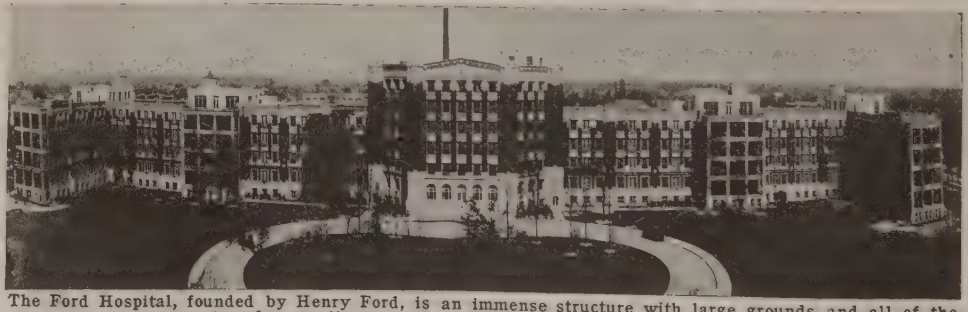
STRIKING BUILDINGS IN DETROIT

The General Motors Building is the largest office building in the world.

The Public Library contains a large collection of books and some interesting historical relics.

Belle Isle in the river is an attractive natural park with many fine trees.

The Book-Cadillac Hotel would do credit to any city in the world.

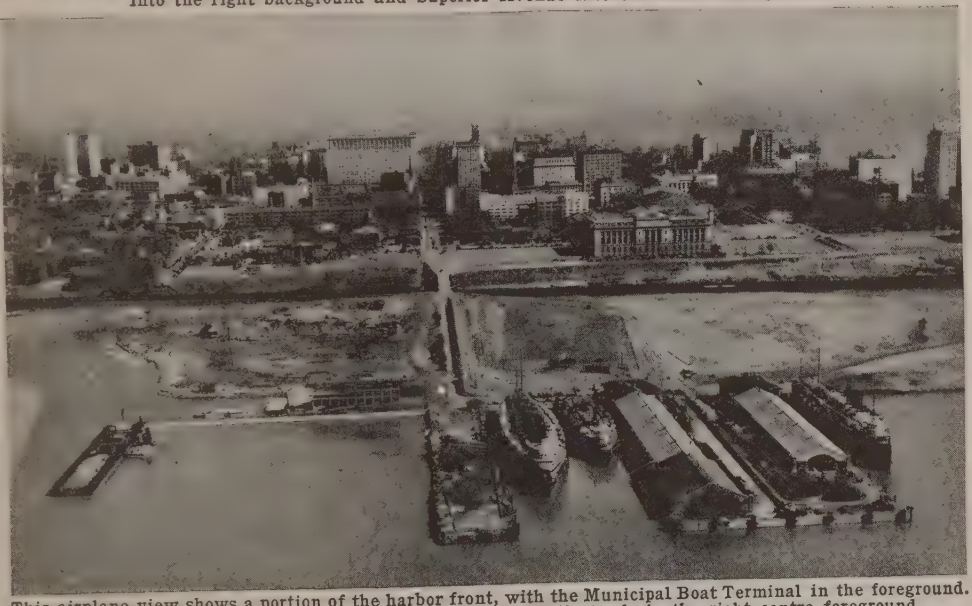


The Ford Hospital, founded by Henry Ford, is an immense structure with large grounds and all of the most modern appliances and conveniences for the care of the sick.

Photos, courtesy Detroit Convention and Tourists' Bureau.

CLEVELAND, THE LARGEST CITY IN OHIO

In this view of Cleveland we are looking east across the Public Square, from which Euclid Avenue reaches into the right background and Superior Avenue into the centre background.



This airplane view shows a portion of the harbor front, with the Municipal Boat Terminal in the foreground. Ninth Street runs through the centre, and the City Hall stands in the right centre foreground.

This beautiful building, the Cleveland Museum of Art, classic in its architecture, is in Wade Park. Its collections represent the most careful selection, and form an increasingly valuable centre of culture and education.

Photos, courtesy Cleveland Chamber of Commerce.

of railroads has been constantly improved; similar improvements have not been made in the river service. A train may travel thirty or forty miles an hour; river boats travel at the rate of from five to twelve miles an hour.

Large sums have been spent to improve the navigation of the Mississippi and its tributaries, but without much plan. It is hoped that a complete plan will be worked out. The railroads took commerce away from the rivers, but they can no longer carry it all. The Federal Government has established a barge line between St. Louis and New Orleans, and modern docks have been built at St. Louis, Memphis and New Orleans.

The Ohio River once had a very important commerce in coal and iron and steel products. Recently barges have brought iron and steel goods from Pittsburgh to St. Louis. It is expected that river boats will soon be making regular trips between St. Louis and St. Paul. It has been announced that during the summer of 1926 river boats will ply between Kansas City, Missouri, and St. Louis.

Chicago some years ago completed the Chicago Drainage Canal through which water from Lake Michigan flows into the Illinois River, a tributary of the Upper Mississippi. While this canal was built primarily to dispose of the sewage of Chicago, it was hoped that the canal would become part of a Lakes-to-the-Gulf waterway. Slack water dams, so as to hold the water back to deepen the river, have already been constructed in the Illinois and Ohio rivers. It is probable that the waterways of the North Central states will in the future become increasingly important in transportation.

WHY MANY PEOPLE LIVE IN CITIES ON THE GREAT LAKES

Duluth and Superior, twin cities, are at the western end of Lake Superior. To the west of these cities are iron-ore deposits, forests and wheat-fields, but there is no coal, although the winters are long and cold, and manufacturing is not very important. You can see why the cities must have a great trade.

Chicago was located at the mouth of the Chicago River near the southern end of Lake Michigan. This settlement became a lumber centre, since it was between the prairies to the south and west and the northern forests. In this city coal from southern Illinois meets iron-ore from the Lake Superior mines. Large blast furnaces have been erected. To the south and west is the best-developed large area of farm land in the United States. Most farming implements are made of iron and steel and wood. Chicago leads all cities in the production of farm implements.

It is more economical to send animal products to consuming markets in the form of meat and lard than to send live animals. Meat-packing plants, therefore, are near the farms where the animals are fattened for market. Chicago reaches out into the Corn Belt and beyond with its many radiating railroad lines. Thousands of cattle, hogs and sheep reach this market. While Chicago is the largest meat-packing centre, other cities farther west, as St. Paul, Omaha, Kansas City and St. Louis, are also important.

Railroad lines connecting the East with the region west of Lake Michigan must pass around the lake. These lines pass through Chicago. This city no longer depends on the mouth of the river for its harbor. A great artificial harbor has been built in the lake. So many railroads have been built to Chicago that it has become the greatest railroad centre in the world. The many radiating railroad lines have helped Chicago to become the largest grain market of the United States.

A hundred miles to the north of Chicago another lake city, Milwaukee, was located at the mouth of a river. Tanning extract, secured from the oak forests of Wisconsin, was used in the tanning of hides. Although this city no longer depends on near-by oak forests, the advantage of an early start has helped it to remain a leading leather centre. As you would expect, the manufacture of shoes is important. All of the shore line of Lake Michigan, from Gary, Indiana, to Milwaukee, Wisconsin, has the same general advantages. It is probable that in time this whole shore line will be dotted with the factories and the homes of many people.

Toledo and Cleveland, Lake Erie cities, were located at the mouths of small rivers. Detroit was located on a narrow passage between Lake Huron and Lake Erie. These cities have the same general advantages in securing raw materials and

GLIMPSES OF SEVERAL CITIES

American Legion Building in Indianapolis, national headquarters of the Legion.

The Masonic Temple in Topeka, Kansas, the third city in size in the state.

Milwaukee, Wisconsin, is the largest city in the state and the thirteenth in the Union. On the left is the striking City Hall, and on the right the Court of Honor, Grand Avenue.

Looking east on Washington Street, Indianapolis, one of the principal business streets.

Looking west on Douglas Avenue, Wichita, Kansas, the second city in the state.

Photos of Indianapolis and Topeka, courtesy of the respective Chambers of Commerce.

in shipping manufactured products that the Lake Michigan cities have. Toledo has large flour mills. Detroit is the leading automobile centre of the world. Cleveland also makes many automobiles and a great variety of iron and steel goods. Not far from Cleveland, at Akron, Ohio, is centred the manufacture of automobile tires.

In the early part of the last century, St. Louis was larger than Chicago, and Cincinnati was larger than Cleveland. Now, Chicago is over three times as large as St. Louis, and Cleveland is over twice as large as Cincinnati. The lake cities began to push ahead of the river cities when canals were built. One canal connected Cleveland with the Ohio River, another canal connected Chicago with the Illinois River. The lake cities reached out and captured commerce that had been going to the river cities.

THE NORTH CENTRAL STATES HAVE MANY LARGE RIVER CITIES

While the lake cities have grown more rapidly than the river cities, the river cities have not decreased in population, but have also grown very rapidly. Cincinnati was located on that part of the Ohio River which is nearest to Lake Erie. Meat products, so important in the early days that it was called "Porkopolis," are still important. The hardwood forests of Kentucky and Tennessee are not far away, while iron and steel can be brought by rail or water from the Pittsburgh district or from the iron-and-steel centres of the Great Lakes. The leading industry is the manufacture of machinery for mines and factories and of implements for the farms.

St. Louis was founded on the Mississippi River at a favorable site about twenty miles below the mouth of the Missouri River. Its location between the mouths of the Missouri and Ohio rivers gave it an early advantage when the rivers were the chief arteries of commerce. To-day the rivers are of less importance. St. Louis now has twenty-six railroad lines extending into its trade territory, and is called the gateway to the Southwest. Its location has made it a large wholesale centre. The manufacture of automobiles is the leading industry, measured by the annual value of the output, but the shoe industry employs the most people. St. Louis manufactures so many different things that a business depression along a few lines does not affect it as much as it would affect many other cities.

Kansas City and Omaha depend for their prosperity on the farm lands near by and the Great Plains to the west. Both cities are important live-stock centres, and meat-packing is an important industry. Kansas City is located at the elbow of the Missouri River, while Omaha had the advantage of being on the line of the first railroad built across the United States.

Indianapolis is the one large city of the North Central states that is not on a navigable body of water. This city is the capital of Indiana, and is surrounded by a rich farming region. Railroads and interurban lines radiate from Indianapolis as spokes from the hub of a wheel. Meat-packing is an important industry.

A BIRD'S-EYE PICTURE OF THE NORTH CENTRAL STATES

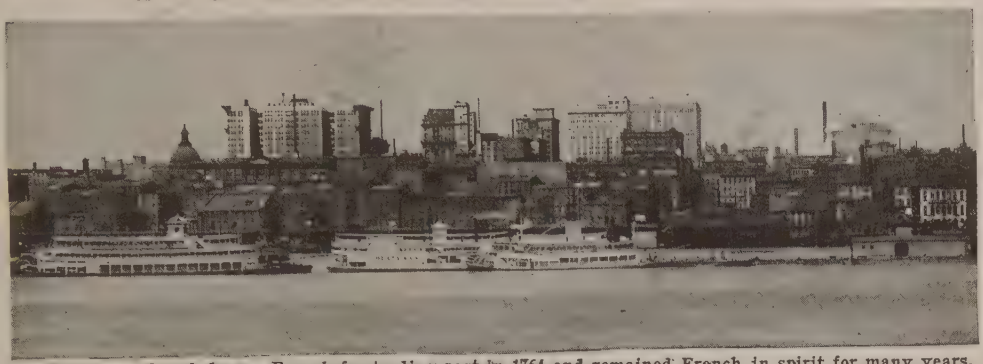
We have noticed the importance of the farms, the forests and the mines. We have studied the development of commercial and industrial centres. The people of the cities depend on the people of the farms, mines and forests for their raw materials and food. The cities in turn supply manufactured products and redistribute supplies.

When we put together the different things we have learned about the North Central states our picture should include the spring-wheat region, the winter-wheat region, the dairying region, the mixed-farming region of the Corn Belt, the fruit districts, the location of iron, copper, salt, coal, petroleum, lead and zinc mines, the northern forests and the forests of the Ozark Upland, the many railroads, and the commerce of the Great Lakes and the Mississippi River system. We should picture the location of several of the largest cities.

We should not think of these things as symbols on a map. Cities should not be mere dots, rivers should not be mere crooked lines. Our pictures of the industries of this region should not be merely word-pictures. We should think of the thousands of people who are at work on the farms, in the mines, in the forests and in the factories. We should think of the thousands of homes and of the many comforts made possible because of the work that is being done.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6207.

TWO IMPORTANT RIVER CITIES



St. Louis was founded as a French fur-trading post in 1764 and remained French in spirit for many years. This is a part of the sky-line of the business district as seen from the mighty Mississippi.

Cincinnati, called at first Losantiville, was settled in 1788 and is the second largest city in Ohio. This is a glimpse from the Kentucky hills across the Ohio River. Photo, courtesy Chamber of Commerce.

The Jefferson Memorial, the home of the Missouri Historical Society, stands on the site of the main entrance to the Louisiana Purchase Exposition, at St. Louis, Missouri. The building contains relics and records of early days in the Mississippi Valley. Photos of St. Louis, W. C. Persons.

THE TWIN CITIES OF MINNESOTA

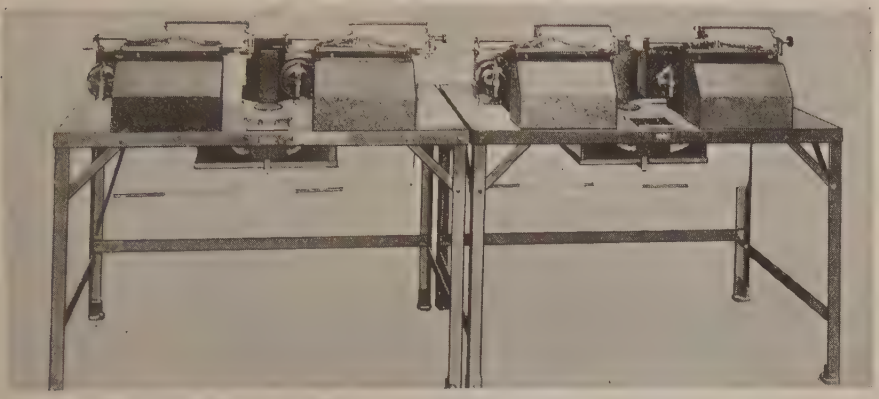
When only a village St. Paul was made the capital of Minnesota Territory in 1849. The present city is built upon terraces rising from the river. This is a part of the business district.

The imposing new Art Museum in Minneapolis.

Gateway Park and Nicollet Hotel, Minneapolis.

Minneapolis as it appeared in 1857. The site of Nicollet Hotel shown above is near the centre of the picture. Joseph Nicholas Nicollet was a Frenchman who explored much of this region.

Photos, courtesy St. Paul Association and Minneapolis Civic and Commerce Association.



Photo, courtesy Morkrum-Kleinschmidt Corporation.
Two double press-receiving sets used for the reception of news items.

HOW WE SEND A TELEGRAM

CONTINUED FROM 5948

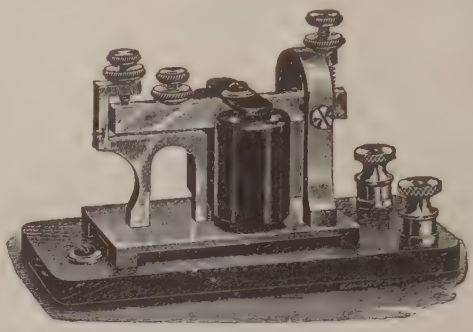
NOBODY can say precisely what what we call electricity really is. It cannot be seen, though its effects can; it cannot be smelled or tasted. We call it a fluid because we cannot give it a better name. But though we do not know what it is, we know how to bring it into use, how to create or excite it, how to harness it and make it our most marvelous and obedient servant. One of the chief wonders electricity performs for us takes place after we hand a telegram to the clerk in a telegraph office. A telegram is one of the familiar things in our lives which are so wonderful that no man can quite understand them.

Delivering a telegram.

If we wish to send a telegram from Quebec to New York, we must have in the first office a battery from which we can send electricity along wires. The wires coil round a piece of iron, and so long as the current of electricity is passing through the coil the iron acts as a magnet—an electromagnet, as it is called—and draws other metal to it. The moment the current ceases, the iron is no longer a magnet. When we send the electricity through this coil we call it "magnetizing the coil." The current flies swiftly along the wire, and while it is going the circuit is said to be closed. When the current ceases, the circuit is broken.

We hand our telegram for New York to the telegraph-operator. Before him there is a little lever with a knob at the end. This lever is called a key. While that key is at rest the circuit is broken. The moment he presses it down or to the side, according to the kind of key, the circuit is closed, and the current races along the telegraph wire. He taps away at his key, and the message flies

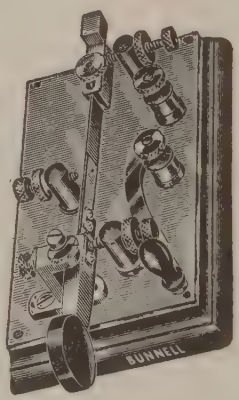
over the wire, to be written down at the New York office. How is it done? New York is the receiving end. At the end of the wire they have an electromagnet, made, as we have seen, of wire and iron. This is called a "sounder." A current comes from Quebec. It enters the New York office by the wire. It passes through the coil and makes the iron magnetic. The magnet attracts toward itself a little metal bar working on a lever, and every time this bar comes down toward the magnet, the end of it taps upon a small screw; when it goes up again it taps on another screw. Each tap that it makes corresponds to something that the clerk in Quebec has done at his end of the wire.



Photos, courtesy J. H. Bunnell & Co.
The telegraph sounder.

The telegraph key.

There are two kinds of telegraph keys. One is pressed down to complete the electrical circuit. The other is pressed to the side and has been nicknamed the "bug" by telegraph-operators. It is claimed that work with the "bug" and its sideways motion does not bring on cramp in the wrist, a calamity that sometimes happens to people who operate an old-type key. On this page we give drawings of a sounder, a key and a "bug."



The sideways key, or "bug."

The Quebec clerk, as we have seen, presses down a key. That key, when at rest, has its knob raised in the air. There is a wire attached to the key. When the key is pressed down, its under-side touches another wire. The pressing-down of the key joins these two wires together. That closes the circuit. The joining of the two wires instantly causes a current of electricity to flow from the Quebec battery over the wire to New York. The instant that the key is allowed to rise from the wire underneath it the current is stopped and the circuit is broken. While the current is flowing, the coil and iron in New York become a magnet which draws toward itself the small metal bar.

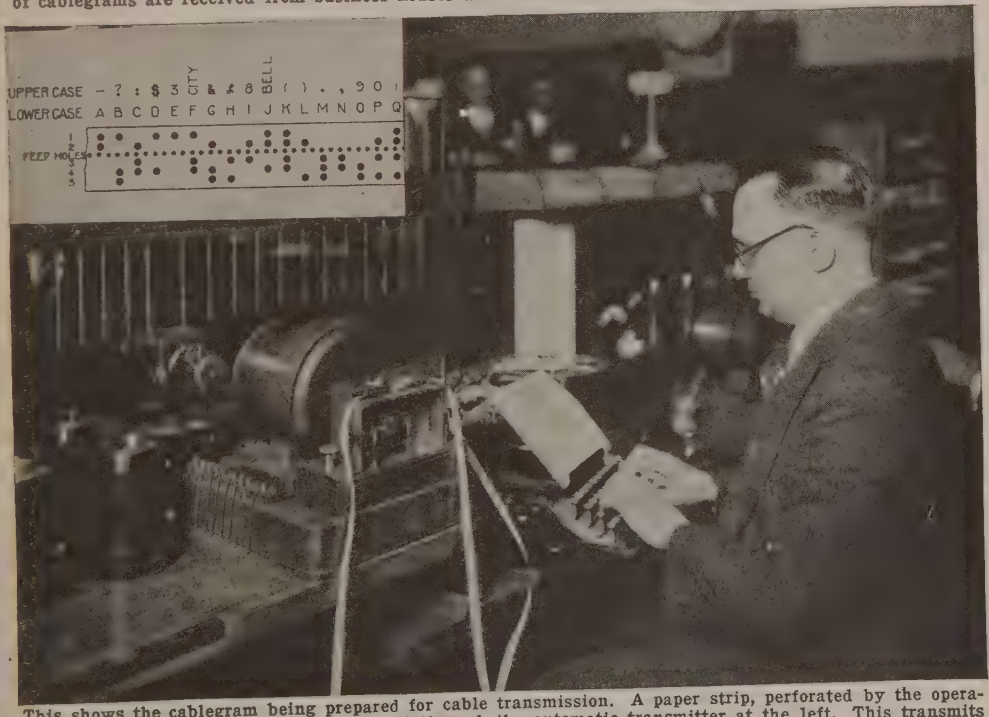
Clever men thought out a way of making this of use. They arranged that certain pressures by the sending key should stand for certain letters. We have only to agree once for all that a certain sign shall stand for a certain thing and then we know what it means. And that is how we got the telegraph's A B C. A very short pressure of the key in Quebec gives two taps in New York, one very quickly after the other; a longer pressure also gives two taps, but with a longer interval between them. These double tappings, one with a short interval between the taps and the other with a longer pause, correspond to the dots and dashes of the Morse alphabet, which we see on the opposite page, and with which you can make words yourself.

When we send our telegram from Quebec to New York the operator turns the letters which we have written into telegraphic letters by tapping away at his key in the manner agreed upon. Each tap is registered in New York as it is made. With each pressure upon the key the circuit is closed, and the current flies for a certain length of time, signifying a sign which means part of a letter. Each time the key is at rest in its ordinary position the current ceases to flow.

But there is a limit to the speed at which a man can tap his key. If he is very skillful and strong he may be able to send as many as forty words a minute.

THE SENDING OF A MESSAGE

This shows one of the telephone switchboards in the central cable office in New York, where thousands of cablegrams are received from business houses and homes to be transmitted to all parts of the world.



This shows the cablegram being prepared for cable transmission. A paper strip, perforated by the operation of the typewriter keyboard, is passed through the automatic transmitter at the left. This transmits from the perforations in the tape directly in the cable. Inset is a piece of the perforated strip.

Unless otherwise accredited, the photographs in this article are used through the courtesy of the Western Union Telegraph Company. Some of the photographs are by Underwood & Underwood.

More likely he will not be able to send more than twenty-five. In fact, on account of the inherent slow speed of the Morse system as compared with the later and faster automatic systems, the Morse system practically confines its use now to short circuits acting as feeders to the longer trunk circuits. For example, the Morse system might be used between Trenton, New Jersey, and New York City, but between New York City and Chicago the higher-capacity automatic-printer system would be used.

The Morse Code.

If a message were filed in Trenton to be transmitted to San Francisco it would first be sent to New York City by the Morse system and then sent by New York over the high-speed printer circuit, being automatically repeated without further manual handling and printed directly in Roman characters at San Francisco.

In all of the largest offices in America there are printing-telegraphs. The operator sits before a machine very much like a typewriter, the keys of which operate five small punches, a definite combination of these five being assigned to each character. These punches perforate holes in a narrow paper strip or tape. The tape is then put into the transmitter, which sends out the electric impulses to the station to which the message is to go. The impulses, as received there, operate a typewriter which prints the message in Roman characters directly on a telegraph form ready for delivery by telephone or messenger. A machine of this sort may send as many as 125 messages an hour, which is more than twice as many as can be sent by key and sounder.

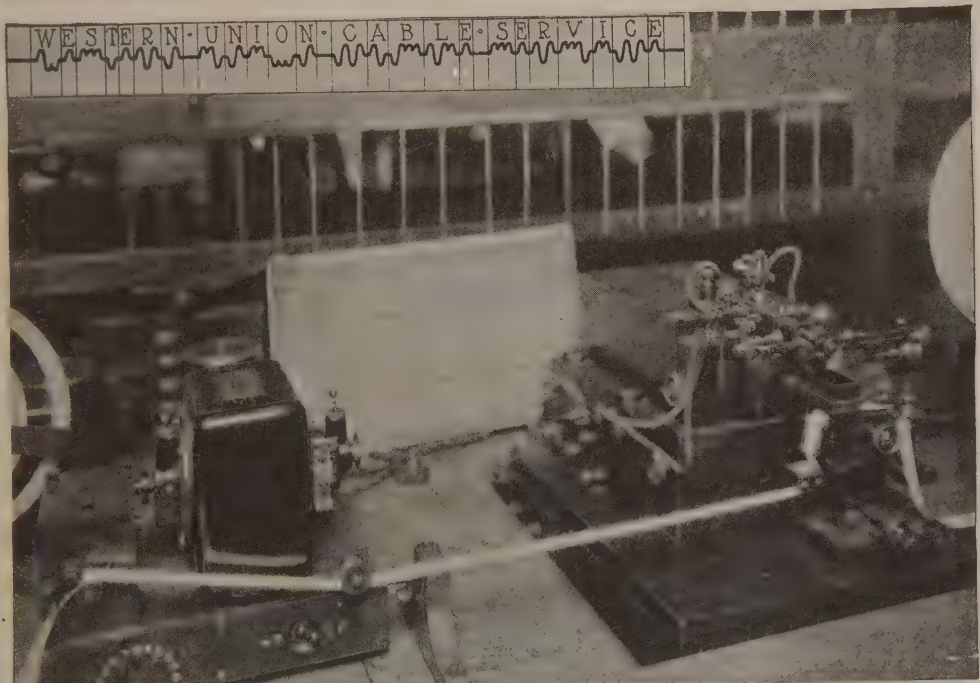
You do not find either of these machines in small offices, such, for example, as those located at the railroad stations in small towns.

Perhaps the greatest wonder of the telegraph line is the fact that several messages can be sent at the same time. Four messages can be traveling over one wire at the same time from Quebec to New York, while four others are coming at the same time over the same wire from New York to Quebec. Approximately 500 messages an hour are handled in this manner. This is done by a marvelous piece of apparatus which acts in an almost human manner to guide each message to its proper printer in one direction and similarly to direct those messages coming in the opposite direction and to prevent head-on collisions between them.

The pneumatic tubes leading to city branch telegraph offices.

HOW A MESSAGE IS RECEIVED

This shows an operator translating signals from the moving tape and typewriting them in message form. The wavy signal is read by expert operators as quickly as an ordinary person reads a line of type.



In this picture we see the delicate siphon recorder which writes the cable signals on a paper tape, as shown in the inset photograph. The vertical divisions are drawn in to divide each letter from its neighbor. Dots are represented by the undulations above the centre line, and dashes by waves below.

If we have relatives away over the sea to whom we may wish to telegraph, we can reach them by a message carried by electricity under the sea. Cables run under the Atlantic and Pacific Oceans, under the Mediterranean Sea, the Black Sea, the Indian Ocean, the North Sea, the English Channel and other large bodies of water. There are approximately 450,000 miles of these submarine cables in use, so that we can exchange messages with England, Hawaii, Australia, New Zealand, India, China and many other countries. The principle is the same as in the land telegraph, but the wires are different, and the rate of telegraphing is slower, as the current passing through these long wires is necessarily weaker, which makes the recording of the messages received a slower operation. We describe the cable on page 4293.

The speed at which cablegrams can travel is still very great, and messages can be punched on a tape, and the dots and dashes be marked on another tape at the end just as on land. A signal has been sent 8,000 miles under water in a single second. As it costs twenty cents a word to send a full-rate cable across the Atlantic, codes are used by which one word may mean a dozen or more. Both parties must have a copy of the code. By this means time and money are saved. Special cablegrams, known as cable letters and week-end letters, cost less than full-rate cablegrams. From New York to London a twenty-word week-end letter may be sent for one dollar. Once an English firm cabled to their manager in Victoria, British Columbia, and received the answer in a minute and a half. The distance there and back is 18,000 miles. If all wires were kept clear, and no delay or mishap occurred, it would be possible to send a message around the earth in five minutes.

Up to the year 1924 there had been no radical improvements in the speed of signaling over ocean cables. In that year, however, a new type of cable, known as "permallay," was laid between New York and the Azores which permitted six times the speed to be obtained.

THE WONDER OF TELEGRAPHING WITHOUT WIRES

Undoubtedly the most wonderful method of telegraphing is that without wires. It has been known for many years that electric waves are carried through the air in all directions with the speed of light, and this knowledge has been turned to useful purposes. The story of wireless messages is told on page 6363.

By the use of an instrument called a transmitter these electric waves can be sent bounding forth through the air in all directions. By making a receiver in tune with the transmitter we can make that receiver take a message, but it will not hear messages with a different wave length.

Thus, we send a message thousands of miles across the ocean without the help of wires. Here, again, the rate is slow. Cablegrams run off at the rate of fifty words a minute, but the wireless telegrams go at the rate of only twenty-five words a minute. Some day, of course, this pace will be greatly improved. Wireless telegraphy is one of the great gifts of inventors to mankind, and we cannot yet realize the importance of it to the world. The pictures on these pages show how wonderful is the power that wireless telegraphy gives us to speak across the sea.

THE WIRELESS TIES THE SHIP TO THE LAND

Let us picture to ourselves an immense liner moving slowly from its berth. The quay is crowded with people waving their hands and fluttering handkerchiefs. From the side of the ship, on all the decks, leans a multitude of passengers waving farewell. The space between these two crowds slowly widens. Between ship and shore flows an increasing space of troubled water. The faces of people become indistinct. The sounds die away. Then the engines get to work, and the great ship moves forward and draws impressively to sea.

The passengers send messages of affection, or of business, to their friends on shore, and perhaps a tiny newspaper giving the news of the world may be printed on the ship. Perhaps a fog may roll over the sea some night and cause an accident. Perhaps you have heard of some of the many occasions on which lives have been saved through the wireless telegraph during the World War. Ships attacked by submarines sent out calls for help.

Small wireless outfits are sometimes carried on airplanes or balloons, and

In the printing-telegraph machine, telegraphy is now used instead of an operator punching a Morse key. The people at the machine in this picture are sending and receiving messages over a large multiplex circuit between two cities. Sixteen operators are working on a single wire, eight operators at each city.

You have noticed in the newspapers every day long lists of prices of stocks and bonds. To get these, many wires connect cities having stock exchanges with newspapers, brokers and private offices throughout the country. The inset shows the latest type of stock ticker.

during the World War scouts or observers gave wireless signals to the artillerymen, telling them to aim higher or lower, or to one side or the other, or gave warning of enemy movements. As you may imagine, however, a man high in the air does not stop to send very elaborate messages. Lighthouses may be equipped to send out danger signals.

ANOTHER DREAM OF SCIENTISTS COMES TRUE

In 1925 another dream of the scientists came into practical use. This time it was the American Telephone and Telegraph Company's new system of electrically transmitting photographs by telephone wires. On Inauguration Day it had its baptism of fire and came through unscathed and with flying colors.

Nine photographs recording the high spots of the Inaugural ceremonies as they "broke" were promptly sent over the transcontinental lines. As quickly as they arrived and were developed, duplicate prints were made and distributed to waiting representatives of the press. All of the cities mentioned reported the successful receipt and publication of excellent photographs at a speed indicating a new chapter in the history of news-picture distribution.

The purpose of the Inaugural test was to demonstrate the capabilities of the new system over transcontinental distances. Four cities were connected together, the arrangements being such that pictures were sent from Washington, D. C., to New York, Chicago and San Francisco simultaneously. The length of the telephone line between Washington and San Francisco via New York is about 3,600 miles.

This system of transmitting pictures electrically was first publicly tested in essentially its present form in May, 1924. The demonstration of March 4, 1925, was in anticipation of the opening of a transcontinental picture-transmission service shortly to be announced.

A PICTURE CAN BE TRANSMITTED OVER A TELEPHONE LINE

The system is a development of the engineers of the American Telephone and Telegraph Company and the Bell Telephone Laboratories, Incorporated. It is the outcome of work covering several years, and provides a simple, rapid and accurate picture-transmitting system which will operate over a telephone line. The apparatus represents the association of many recent inventions by telephone engineers, together with standard types of telephone and telegraph apparatus which have been readapted to this use.

The simplicity of the method is such that a positive transparency film is suitable for transmission. The apparatus is so designed as to transmit a picture five inches by seven inches in seven minutes. The picture is received in such form that after photographic development of the usual sort it is practically undistinguishable from an ordinary photograph and is ready for newspaper or other reproduction. Line drawings, handwriting and printing can also be transmitted. As films can be used for transmission while still wet, the system eliminates the delay which would otherwise be caused by drying and by making special sending plates.

The film upon which a picture has been transferred is inserted in the transmitter simply by rolling it up in a cylindrical form. During operation a very small and intense beam of light shines through the film on to a photo-electric cell within. The film is rotated at a uniform speed, and by means of a screw mechanism is caused to advance parallel to the axis of the cylinder. The motion of the light relative to the cylinder is therefore the same as that of a phonograph needle relative to cylindrical record. In this way each minute portion of the picture in turn affects the intensity of the light reaching the photo-electric cell. This variation in the amount of light striking the sensitive surface of the cell gives rise to a current which, through the agency of a vacuum-tube amplifier and modulator, controls the current flowing through the telephone line.

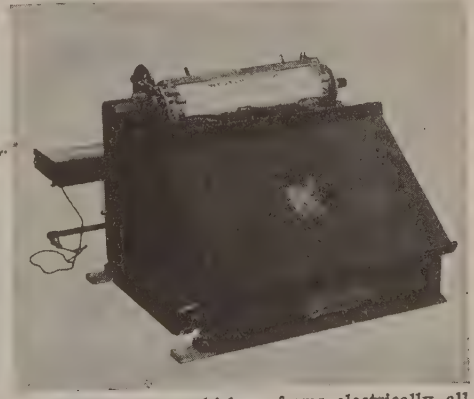
At the receiving end an unexposed photographic film is rotated under a beam of light in a manner similar to that at the transmitting end. The two films are caused to rotate at exactly the same speed, and the impulses starting from the photo-electric cell at the sending end control, by means of a new device known as a light valve, the amount of light reaching the film at the receiving end.

The system is applicable to radio transmission of pictures when atmospheric conditions are such that steadiness of transmission and freedom from interference can be assured.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6183.

THE PRINTING-TELEGRAPHS AT WORK

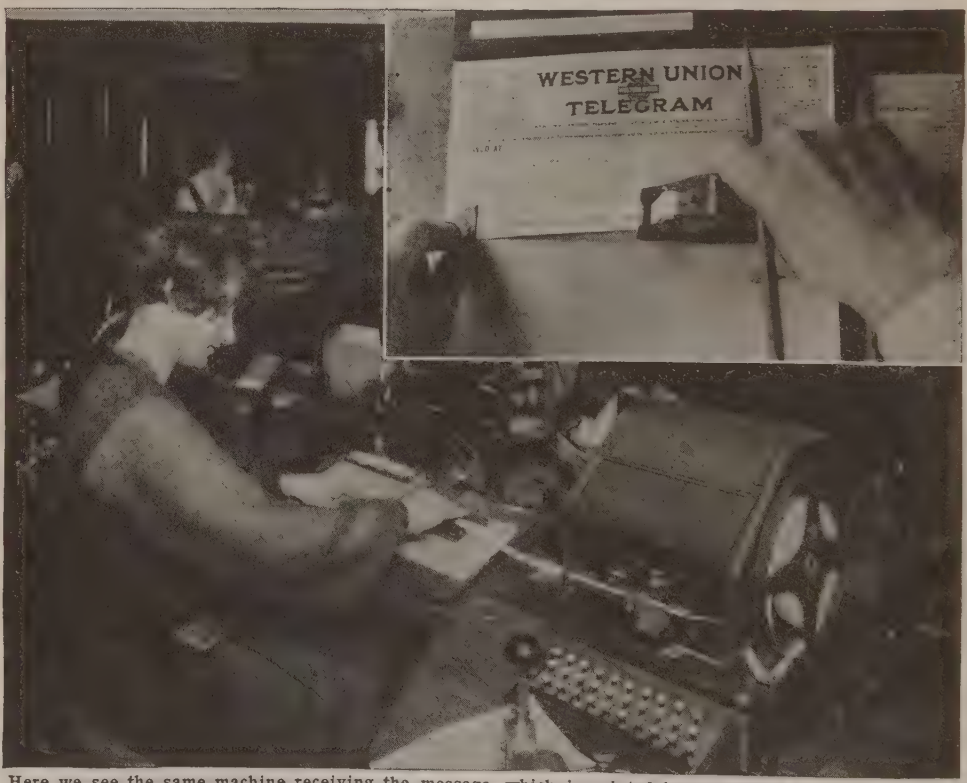
The multiplex printing-telegraph machine does not require regular telegraph-operators. There is a typewriter keyboard in front of the operator, and as she strikes the keys holes are punched in particular positions on a tape as it passes through and into the automatic transmitter at the left of the picture.



On the right we see a detailed view of the automatic multiplex printer which performs electrically all the functions of a typewriter at the will of the distant operator who manipulates the keys of the typewriter-like instrument on the left.

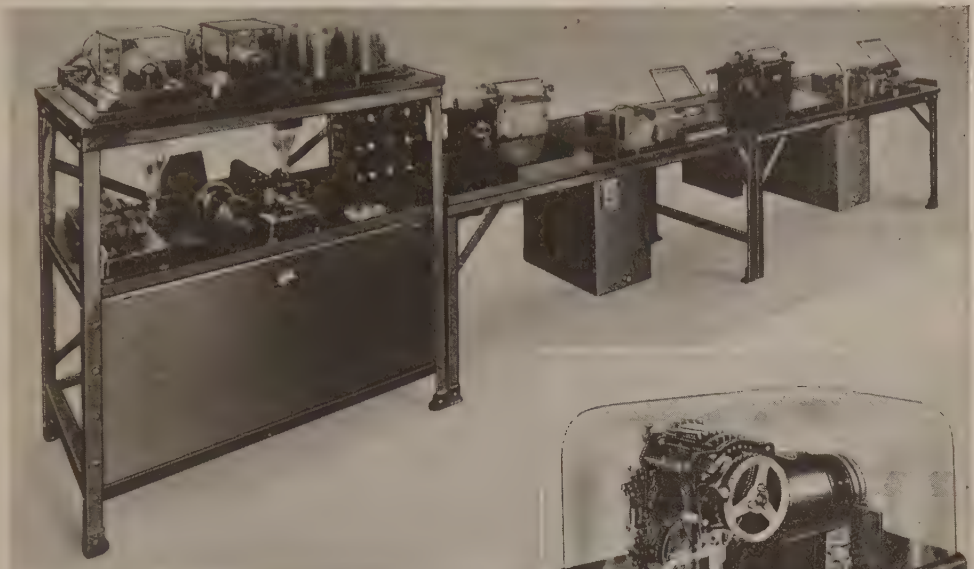
A DUAL-PURPOSE TELEGRAPH MACHINE

The growing need for quicker communication in business has been met by this dual-purpose machine called a simplex printer. It is installed in the business office alongside the typewriter or telephone. As its name implies, it is so simple that any office employee can quickly learn to operate it.

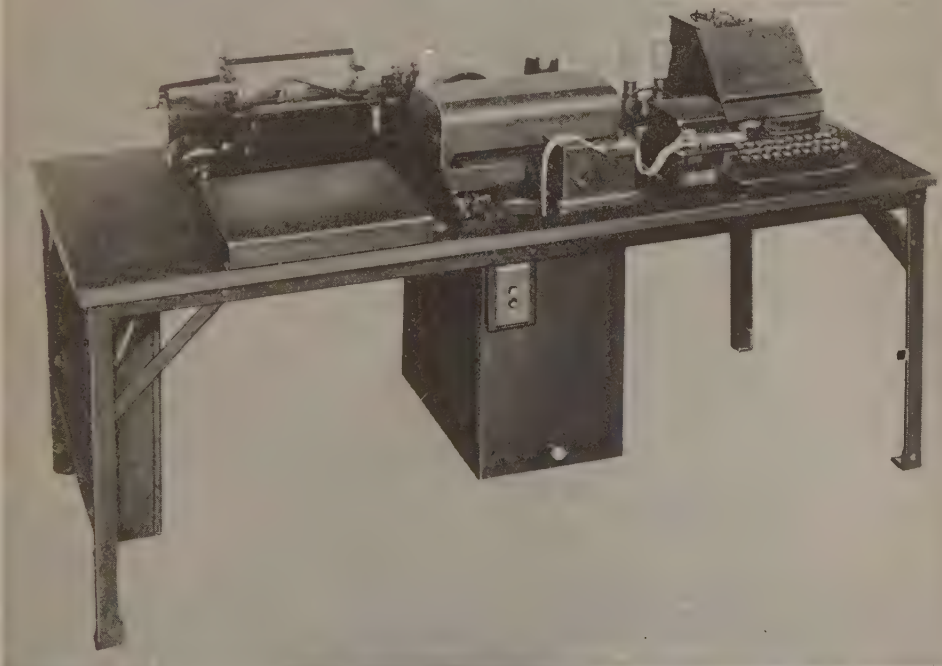


Here we see the same machine receiving the message, which is printed by typewriter mechanism on the narrow white tape. As the tape leaves the machine it is pasted on a standard telegraph form, as shown in the inset. The simplex printer is used also between the telegraph company's main and branch offices.

THE MAGIC MACHINES THAT BRING NEWS



This photograph shows the multiplex apparatus used for simultaneously sending and receiving over two, three or four channels. The Postal Telegraph Company uses this between large cities.



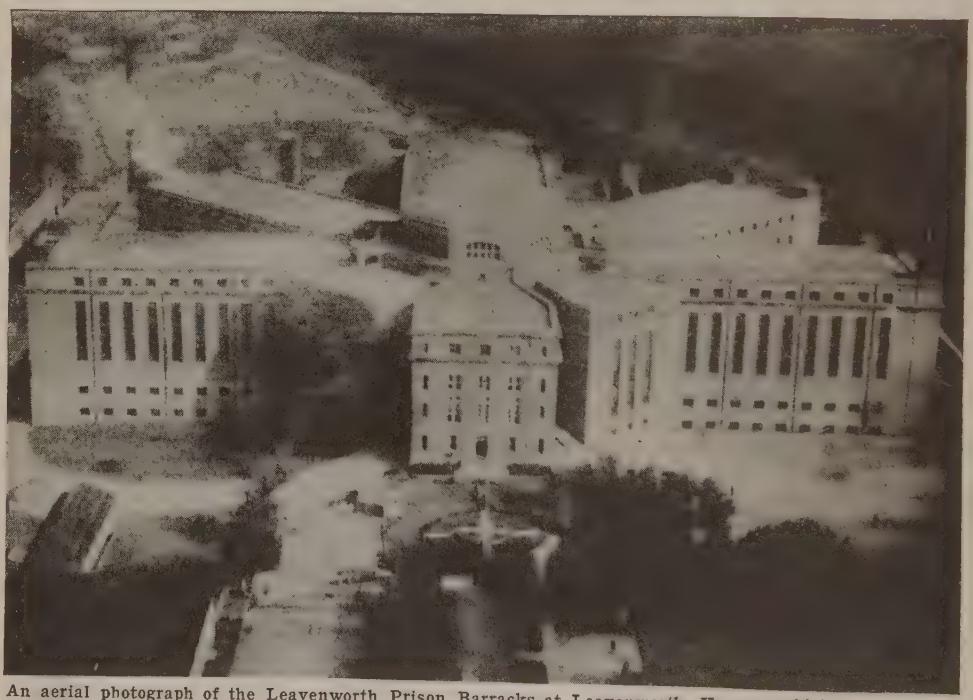
Inset is a receiving typewheel teletype. This machine can only receive messages. These are printed on half-inch paper which feeds out at the left-hand side of the teletype. The lower picture shows a duplex set of Morkrum-Kleinschmidt page teletypes, used for the simultaneous transmission and reception of messages in printed form.

Photos, courtesy Morkrum-Kleinschmidt Corporation.

PHOTOGRAPHS SENT BY WIRE

This photograph was sent by telephone from Santa Barbara, California, to New York, showing destructive effects of the earthquake of June 29, 1925. View looking up State Street, Hotel Californian in the foreground.

© Underwood & Underwood.

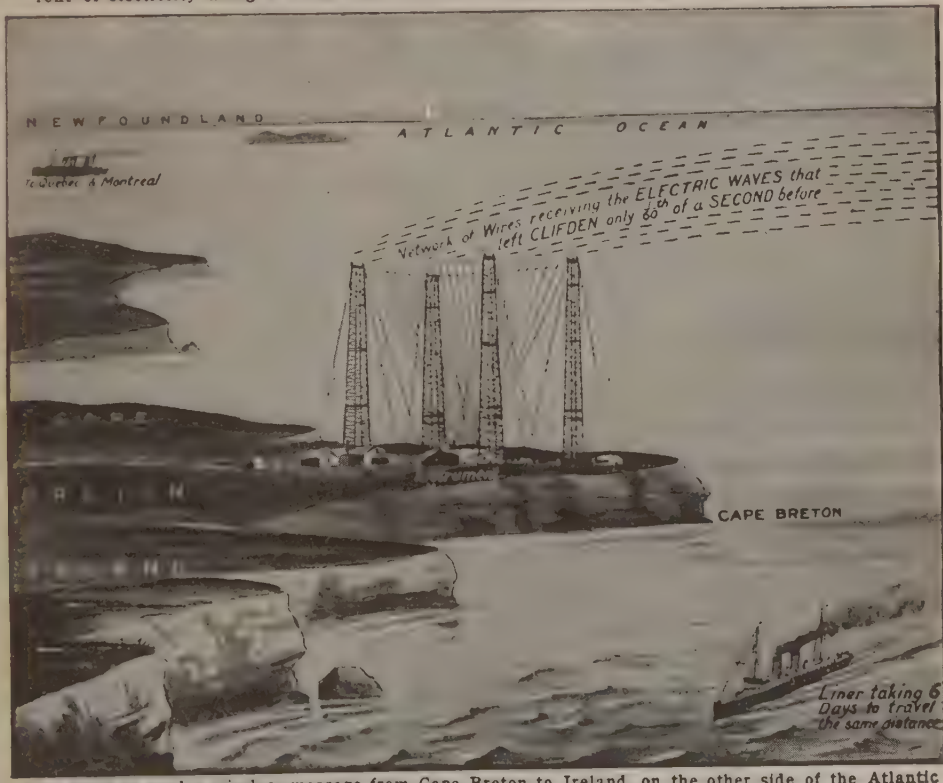


An aerial photograph of the Leavenworth Prison Barracks at Leavenworth, Kansas, which was received at the American Telephone and Telegraph Company office in New York exactly seventeen minutes after it was snapped in the air. The photograph was snapped, developed in the air and put on the wire in a few minutes. It was part of a test in which the Army Air Service co-operated with the Telephone Company.

Photo, Wide World Photos.

MESSAGES THAT FLY THROUGH SPACE

Here we see the latest invention in telegraphy—the wireless system. We tap a key and send a current of electricity along a wire. From the end of this wire the current flashes across the sea.


NEWFOUNDLAND
ATLANTIC OCEAN
To Quebec & Montreal
Network of Wires receiving the ELECTRIC WAVES that left CLIFDEN only 60th of a SECOND before
CAPE BRETON
Liner taking 6 Days to travel the same distance

If we want to send a wireless message from Cape Breton to Ireland, on the other side of the Atlantic Ocean, we tap our key, and the message flies the 2,000 miles in one-sixtieth of a second.

The safe running of railway trains depends greatly upon the sending of messages swiftly from one station or divisional point to another. Here we see the large force of telegraph-operators in the Canadian Pacific Telegraph office at Calgary. Photo, courtesy Canadian Pacific Railway.

Photo, courtesy Canadian National Railways.

Here we see the Montreal station of the Canadian National Telegraphs and Anglo-American Cable Company at the moment when history was made in the speedy sending of messages across the Atlantic. A message was sent, on a machine operating automatically, by the Mayor of Montreal from Montreal to the Prince of Wales, in London, England, and an answer was received in two and a half minutes.

The larva of an American cicada leaves its underground home and grows into a winged insect.

THE MIGHTY INSECT

CONTINUED FROM 6020

Colorado Beetle.

LINNÆUS, the great naturalist, once made a statement which must often have caused young people to think him mad. "Three flies," he said, "consume the carcass of a horse as quickly as a lion could dispose of it." We shall ask, not three flies, but one fly, to help us to a solution of this famous old enigma of Linnæus.

A fly begins to lay eggs in the middle of April. Its eggs number, as a rule, about 120. These hatch in two weeks, and ten days later the females of the new generation lay *their* eggs in turn. Generation succeeds generation throughout the summer and on into September, the great fly month of the season.

Now, if all the descendants of the April fly live and produce eggs, the progeny of that first fly, after a lapse of the five warm months of the year, number the unthinkable total of about 5,600 million insects. That is the meaning, told in figures, of the saying of the immortal Linnæus which must often have perplexed the little naturalists of his day.

It serves here to prepare us for the task of thinking in vast numbers, for all the Orders into whose stories we have so far probed are numerically but a handful compared with those of the insect world.

We know already some 400,000 species of insects, and believe that ten times as many remain to be named and described. Their powers of multiplication have no parallel in the animal world. It is true that some of the animals that live in the water multiply rapidly, but there we can count only the prodigious total of eggs produced by the mothers, not the young which grow up.

In the insect world the death-rate is not so high, perhaps; there is greater seclusion and safety than in the open waters, and the result is that insects number incredibly more than all the other forms of life added together. They are tiny things—5,000 big honeybees go to the pound; yet if we could mass all the great and small animals, birds and reptiles together in one huge scale, then put into the opposite scale the insects that people the earth, the tiny things would be so colossal in total that they would far outweigh all the rest. This is true even though the elephants, rhinos, hippos, oxen, horses and whales were on the other side.

Their enormous numbers are due in part to the fact that they reach full growth with extreme rapidity and become parents almost at once. There is also, of course, their great fertility to be considered. A queen bee lays as many as 80,000 eggs; while the queen

of a white ant, or termite, colony produces her eggs, thousands and thousands of them, at the rate of one a second.

Naturally these great numbers affect the fortunes of the human family. They are mingled bane and blessing. They are carriers and distributors of terrible diseases, agonizing and fatal to man and beast. They can destroy our forests, and make a desert where a fruitful land was. They can eat up our vegetation and starve our cattle. They have, from the dawn of human enlightenment, been the agents which have defied and stricken us when we have sought to thrust out the bounds of civilization in tropical and subtropical lands.

THE GREAT DEBT OF MANKIND TO THE INSECT KINGDOM

On the other hand, we have humbly to confess ourselves unendingly in their debt. Except where we ourselves have captured and improved some of the wild species, the flowers with their scents and sweets are there to crave the favor of insects. Plant life needs fertilization for the making of the seeds out of which its new generations will develop. The insects are the beasts of burden which convey the vital pollen from one flower to another. To charm the senses of insects the flowers distil their nectar and breathe on the air their sweetest odors, and light the way to their treasure-house with all their colors.

Not all insect visitors are welcome. Some are robbers who take without giving in return. Where the arrangement between insect and flower is of ancient standing, the modifications of the plant and of the insect are such as to beggar imagination. The plant has its beautiful traps and adaptations, some of them noble little examples of engineering, some of them grimly comic snares; some, of course, as in the case of the insect-eating plants, treacherous paths to miserable death.

CUNNING WAYS IN WHICH INSECTS ARE LURED TO FLOWERS

Those are exceptions; in general the special lure and reception chambers of the insect-wooing flower are dreams of lovely gentle cunning. And the insects, on their part, are as marvelously furnished in order that they may co-operate with their hosts. There is a tropical flower with a bell so deep that only a special type of moth proboscis, one of abnormal length, could penetrate its depths. A great scientist predicted the existence of such a moth. It has been found, with precisely the length of sucking tube required.

Certain clovers grow only where the bumblebee exists to fertilize them. When the first clover was planted in New Zealand, it was necessary to send a load of bumblebee queens to make it grow and establish itself on the other side of the world, and so provide food for the domestic animals, which at the same time were being sent to that lovely island of the Pacific. Also queen bees have been sent to Japan to perform a like work for the fruit orchards there.

Remote as their lives seem from ours, the insects have a very intimate association, for good and ill, with human existence and prosperity. Nature provides us with ladybirds to police the orange and lemon orchards where scale fatally abounds; the caterpillar of a moth spins silk to form one of the richest industries in the world.

HOW INSECTS HAVE HELPED ON THE TRADE OF THE WORLD

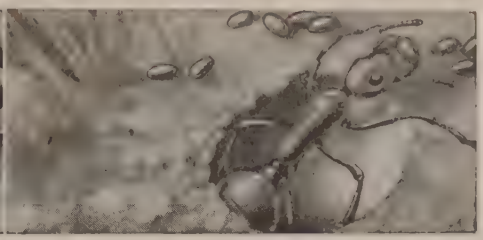
The lac and cochineal insects have for ages been among the indispensables of commerce; a certain fly with a saw-like implement is responsible for the qualities of the Smyrna fig; a wood-boring beetle necessitated the presence in certain trees and vines of a bitter protective latex which finally man found to be convertible into rubber. On this depend the motor car, the airplane, half the vessels in surgery, and nearly all the insulating material for electricity, for the telegraph, telephone, wireless, trains and street cars.

Think, on the other hand, of the aphids on our roses, of the locust gnawing whole crops to the ground, of the warble-fly torturing horses and cattle, of flies and mosquitoes slaying tens of thousands, even hundreds of thousands, of human beings. So, with good effect and evil recognized, we have the insects in their right perspective.

Insects never possess lung-books, but breathe by means of many tubes or spiracles, opening on various parts of the body to the outer air. Along these horny little tubes oxygen is conducted to the blood of the insect and waste air is expelled. As we watch a resting insect we may see it pant. The throbbing of its

ROUND THE YEAR WITH THE CORN-ROOT APHID

1. Fields of corn are often ruined by the corn-root aphid. In January, February and March, in the nests of the small brown ant we can see piles of the eggs of the corn-root aphid.



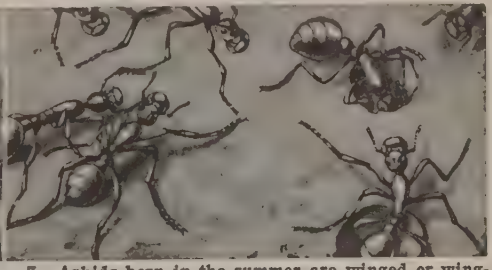
2. On warm days ants bring the eggs to the surface so that they may receive the air and benefit by the warmth of the sun. In very cold weather they carry them farther down into the unfrozen earth.

3. In April and May the eggs hatch out, and the ants carry the young aphids to the roots of the smartweed and foxtail grass. By the end of May the aphids begin to produce young, both winged and wingless.

4. As soon as the corn plants are growing the brown ants carry the aphids to the roots, bringing to them even the winged variety. All through the summer the aphids produce young.

5. All summer the ants attend the aphids, burrowing round the roots of the corn and carrying the pests from plant to plant. In return the aphids furnish sweet honey-dew. The ants stroke the insects with their antennæ, thus milking them as cows are milked. All this time the aphids are multiplying. An aphid produces eggs eight days after it is hatched.

6. Each generation takes about 16 days, and there are 12 generations in a season. If all lived, there would be next spring nine-and-a-half million million aphids, forming a line 7,850,000 miles long.



7. Aphids born in the summer are winged or wingless females, but in September wingless forms are born which develop into ordinary males and females. These females lay the glossy eggs mentioned above.

little body reveals the muscular effort which it exerts in pumping air in and out. This system of bringing air in contact with the blood throughout the body has answered well, for insects are extraordinarily active for the most part, highly gifted in many ways.

THE BLOOD OF THE INSECTS IS COLD

Yet, when we touch the question of insect blood we pause in surprise and perplexity. Insects are ancient; they are numberless; they have inexhaustible supplies of food, for those that bite and gnaw, and for those that pierce and suck. The insects have cold blood, devoid of hæmoglobin, the red coloring matter of blood. Cold-blooded they were, cold-blooded they continue, cold-blooded they must remain. They are committed for all eternity to small forms, and can never become mighty as individuals or species, save, of course, in numbers and in power to slay by their poisons.

THE GREAT TASK BEFORE NATURE IF THE MAMMALS SHOULD FAIL

That is what we mean when we say that should man and the rest of the mammals fail, insects, incomparable in some directions, could never succeed to world-mastery.

Many times we have noted how present-day life repeats in the creation of an individual much of the life-story of the species. The insects afford an example of this more striking even than that furnished by the tadpoles of the amphibians. Here we may trace the egg to the grub, the grub to the chrysalis, the chrysalis to the perfect full-grown insect.

This series of transformations is known as the "metamorphosis." Any child who has reared butterflies from the eggs knows the process. However, there are millions of adults who cannot be brought to believe that these changes occur. They will not believe that the loathsome crawling grub will one day burst its melancholy prison-house and become a radiant creature of the air.

Every rule has its exception, and the irregularity applies to the changes undergone by insects, for not all go through the complicated cycle. Many forms are born in the tiny image of their parents, and are compelled to molt and feed, feed and molt, untiringly, splitting off coat after coat, and growing on again till they attain full size and possess wings.

THE LARVA OF THE DRAGON-FLY WHICH LIVES UNDER WATER

The grand Dragon-fly serves as an example of the midway scheme, where there is a complete change of form and habit, but where the pupa or chrysalis stage is omitted. We find dragon-flies in the vicinity of water, but rarely see them enter it, though they often stoop toward its surface in pursuit of insect prey. But they lay their eggs in that water, and from the eggs comes a strange fierce larva utterly unlike its parents.

The fact that it is slow of motion helps it to get food. So terrifying a little monster, limited in speed, would never catch fast prey if it moved about. It clings to a water weed, hidden by its obscure coloration. But as it clings it can shoot out a horrid clawed lip, like a pair of lazy tongs, and grip like lightning a worm, snail, tadpole, even a dashing baby fish.

Methods differ with species of dragon-flies, and it is interesting to observe that while some of the larvæ get along by waggling the tail like an oar, others employ the ancient plan of the octopus and move by squirting out water violently from the body.

This career of under-water savagery lasts for a year, or even more. At the end of that time the old maggot-like form is exchanged for one resembling a squat beetle. In this guise the creature at last climbs up a plant-stem clear of the water, bursts off its last disguise, and emerges a dragon-fly. It is not yet perfect. The abdomen has to be straightened and lengthened, the wings also; but in an hour one of the most amazing of natural changes is completed, and we who watch know how true were Tennyson's words when he wrote:

> To-day I saw the dragon-fly
> Come from the wells where he did lie.
>
> An inner impulse rent the veil
> Of his old husk; from head to tail
> Came out clear plates of sapphire mail.
>
> He dried his wings: like gauze they grew;
> Through crofts and pastures wet with dew
> A living flash of light he flew.

The dragon-fly is the airplane of insects, but, enormous as is his appetite for insects, which he catches on the wing, he is usually active only when the sun shines. Fortunately his aerial life extends over weeks and months, or we should too soon

lose a precious ally. Very different is the fate of the May-flies.

THE SHORT, GAY LIFE OF THE DANCING MAY-FLIES

When their long probation in the water, with all its varied methods of equipment and procedure for different species, has been completed, out the May-flies come to land, to divest themselves of their last disposable garment. Then away up in the air the females to meet their lords, the males to dance with excited raptures among a thousand rivals for the favor of a lady who is a rare prize among so many courtiers.

Pond and stream and sluggish river seem to come to life as, day after day, the May-flies issue from them. Such hosts appear that again and again we hear rumors in country places of church spires and other buildings being on fire. The imaginary smoke is simply the multitude of air-dancing insects.

Their dance is short. They may live for but an hour, they may live from sundown to sunrise; rarely do they last a couple of days. All the labor and marvels of change and growth which have taken place in the water go to this consummation—so swift, joyous and dramatic. A chicken does not eat, or should not, for its first thirty-six hours of life. A May-fly never eats at all in its perfect form; but, while the baby bird is working up its first appetite, three groups of adult May-flies have come into the air and passed out of life. Yet, in that time tens of millions of eggs have been laid in the water to stock the stream with new hosts of larvæ.

It may seem a great leap from these insects to the White Ants, as the Termites are called, but it is in this direction that affinity leads. The termites live chiefly in the tropics and are not ants, much as some of their habits resemble the true ants. They pass from the larval to the adult condition by a series of gradual changes, but they go through no chrysalis state.

Among the most extraordinary of the social insects, they form vast colonies, either by tunneling trees and throwing out huge barrel-shaped homes around the branches by means of underground cities; or, more characteristic, cities which, with subterranean foundations, rise like massive hollow pillars twelve and more feet into the air.

Within these homes there are scenes of marvelous activity. The city is partitioned into compartments, cells and walled divisions. In the centre are the king and queen, royal prisoners in this sense that the avenues leading to their apartments are made so narrow that the sovereigns cannot escape from them, while the workers can come and go at will.

THE WONDERFUL THING THAT HAPPENS INSIDE THE WHITE ANT'S CITY

All the queen has to do is to furnish eggs; the workers feed and clean her and her mate. She produces her eggs, thousands and thousands a day month after month. In the height of her season of productivity she is a mass of eggs, in some cases two or three inches long, and working like a machine, an egg a second, each carried away instantly by an anxious worker to the nursery.

When the grub hatches it is fed on chewed wood and saliva by its nurses. The grub molts and grows, and if it is to be a prince or a queen, grows both eyes and wings; otherwise it may have neither, but joins the community of workers, sightless and with no organs of locomotion but legs.

Originally termites must have been valuable as devourers of decaying wood in a wild land. We have built out into their domain, and they cause us many a disaster. They eat our telegraph poles; they mine beneath houses and eat the timber supports of the building; they tunnel furniture; they make meals of everything wooden. That in itself is devastating, but the worst of it is that they never start on the visible surface. They tunnel invisibly, leaving a thin shell of material which suggests a solidity that does not exist.

THE DESTRUCTION WROUGHT BY TERMITES IN THE TROPICS

If for nothing else, our magnificent natural-history museums would be worth a visit to see the effects of the termite attacks on lovely furniture eaten hollow by those creatures in the tropics.

A classic example of termite operations is this. They broke out one night from their underground city on which a human house had been built. They ate through the floor and came up beneath the foot of a table-leg. Right up that leg they devoured their way, then through the top of the table, next down another leg to which they had by this time come,

and so through the floor and home again. But they took on the way the late supper left on the table!

Nothing is safe from them—books, clothes, maps, handles of instruments, everything dear to the man pioneering far from the resources of civilization. A seemingly sound house may crash about his ears, riddled by these insects, and with it will vanish the ruined treasures hoarded in library and oaken chest. We have no such problems as these in the North, though some of ours are puzzling.

Following still the same path through this maze of classification, we are led next to a family of *Psocidæ,* which men call Book-lice, winged in most species, wingless in others. Most of the family live out of doors, in moss and lichen, on trees and among fungus and plants, but one species comes into the house.

THE TINY CREATURE THAT EATS ITS WAY THROUGH BOOKS

Although microscopic, it is active and voracious. It ruins our books if left long enough; it devours collections of dried plants, animals and insects, and is the nightmare of the private museum. Bird-lice, which make poultry life unhappy, are distant cousins of the book-lice.

But our progress takes us now to things more to be dreaded than any of these—the group which contains the locusts. First come the Crickets, known to everybody who has lived in the country and heard the cheering chorus of the insects in the fields. A cricket of Europe, Dickens' "cricket on the hearth," lives commonly about the kitchen range, but its American kin are out-of-door folk.

The power of their leap was once impressed on the writer when, in England, a cricket taking an aerial leap landed with a splash into a cup of tea held in the hand of the old lady to whom he was talking; and a nightmare recollection is of a swarm of crickets flying round and round the room one hot summer night when fatal illness made the atmosphere seem wholly terrible to one childish mind.

But crickets are harmless enough, though intolerably noisy and destructive in a small way. Not only do they eat a small amount of vegetation: they have the audacity to gnaw holes in damp clothes which a careful housewife may have left on the grass to bleach.

We have not only the field-crickets, but that wonder of the tribe, the mole-cricket, in which the two fore limbs are short, thick and powerful, with relatively enormous claws outspread like the fore-paws of a mole.

THE STRANGE THING THAT HAPPENS WHEN GRASSHOPPERS LEAP

With Grasshoppers every child is familiar—creatures of the grass, the sunny bank and the wood; but have we all noted that in leaping from danger they turn round in the air, so that on alighting they face in the opposite direction to that in which they started?

The common grasshoppers are hardy little fellows, but our largest species are restricted to the warmer parts of the land where, when we first see them, they are so huge and brilliant that we imagine them to be tropical imports.

As a rule, grasshoppers do little harm to us, although they eat more grass than do the crickets; but the Rocky Mountain Locust sometimes becomes so abundant that great swarms sweep over the western states and parts of Canada, carrying destruction with them.

The habit grasshoppers have of eating other insects fortunately extends to the Locusts, which in time of famine are as pronounced cannibals as anything that lives. To this fact we may owe the survival of agriculture in the hot lands over which these creatures sweep from time to time in their high-tide billions. If all lived and bred, vegetation would die before their remorseless advance.

They are many in species, and vary from a quarter of an inch in length to ten times that size. All have the common habit of drilling holes in the earth in which to lay their eggs. From the eggs come little locusts, like their parents, but wingless until they have fed and molted over a period which embraces half a dozen castings of skin.

Both then and later, when the wings have come, the insects are fiercely voracious, and devour every green thing within reach and each other. When wings arrive, if the number of adults is too great to be accommodated by the land in which they feed, they rise and fly afar. The course of the winds undoubtedly influences their direction, for locusts which have emigrated do not fly back to the place whence they or their ancestors came.

A nucleus always remains at the origi-

TWO DESPOILERS OF OUR WOODS AND ORCHARDS

The tiny codlin, or codling, moth lays an egg on an apple-blossom. The grub eats into the fruit and remains until grown, when it comes out to spin a cocoon from which a moth emerges. The same cycle is repeated.

This ugly worm, which is one of the stages in the life-history of the gipsy moth, has ruined thousands of valuable trees, and efforts to combat it have cost a great deal of money.

Photos, Brown & Dawson.

6069

nal source, and to-day the old nursery exists in Northern Africa from which were derived the frightful masses that constituted the locust plague of Egypt in the days of Moses.

THE SWARM OF FLYING LOCUSTS TWENTY-FIVE MILES LONG

There are locusts in Southern Europe and its islands, in Africa, in Asia and in America. Everywhere from time to time they swarm in their billions, as lemmings swarm in their tens of thousands. But lemmings march slowly; the locusts fly with the speed of the wind plus their own speed, far and unweariedly, so that they can strike distant scenes of apparent safety as aircraft can now strike at what were formerly inaccessible islands.

To imagine their flying swarms we must recall the sum set by Linnæus and the horse-devouring larvæ of his three flies. One swarm is like another, save that some are greater than their fellows. One which scourged the land around Pretoria, in South Africa, in modern times was estimated to be twenty-five miles in length, one and a half miles broad, and half a mile deep.

Johannesburg witnessed a flight in which the countless multitude made the white mountains brown, the sky dark as night, broke down the telegraph and telephone wires by their weight, stopped the railway service by making the lines impassable, and caused street cars to run backward downhill, their crushed bodies rendering the rails too slippery for the brakes to act.

An earlier swarm was said to cover two thousand square miles of land. When, providentially, a great wind arose and swept them into the sea, the tide cast up on the shore a solid bank of dead and putrid locust corpses four feet high and fifty miles in length. Those are African figures, yet the little island of Cyprus in the Mediterranean in a single year destroyed two hundred millions of the insects.

THE HUNGRY HOSTS OF LOCUSTS BEGIN TO EAT ONE ANOTHER

All vegetation of field, forest and plain disappears down their throats and is insufficient, so that locust eats locust. By their very numbers they automatically reduce their multitudes and so save great areas from being laid bare. Even so, the locust problem is one of the unsolved terrors of the world.

Many of the grasshoppers are marvelously colored to resemble vegetation. They prepare us to view the still greater marvels of their cousins the stick and leaf insects, in which imitation attains perhaps its pinnacle of perfection. The Stick Insects have long cylindrical bodies which nothing but the movements of the creature reveal as not being part of the tree or plant itself. The Leaf Insects pass for foliage of the plant on which they rest. Their limbs contribute to the deception by looking like leaf and twig combined.

They are all insect-eaters, and so are their kindred the praying insects, to which the familiar praying mantis belongs. Here an extraordinary development of the two forelegs lends itself to an attitude of motionless rigidity. The creature seems to be holding up its limbs in prayer till a possible victim hovers near. Out go the treacherous limbs like lightning, and the mantis's dinner is secured.

THE ELUSIVE COCKROACHES THAT CREEP INTO OUR HOUSES

It seems a big stride from these wonders to those horrors of our homes, the Cockroaches, but such is the track of relationship. Some kinds have wings when mature, others none; but, with wings or without, they are masters of action on the ground—fleet, elusive, cunning. We have many native species, but those which infest our houses are importations from the tropics and die if exposed to cold.

They are one of the minor plagues of life, crawling over food and corrupting it, sparing nothing from their foulness. On shipboard they are hated with reason. At night they will nibble at the hair and at the skin at the base of the finger-nails of the sailors. It is believed that they do the same to the skin around the nails of the elephants' feet at the zoo.

No such charges can be urged against their allies the Earwigs. Though these come into the house, led by ivy and creepers to rooms whose light attracts, they keep in the main to the garden. While true to their natural rôle as devourers of garbage, they do serious damage to flowers in some localities.

THE GREAT COMPANY OF TEN THOUSAND CURIOUS CREATURES

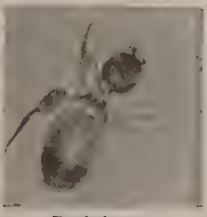
It would be pleasant if the true bugs treated us no worse, but of this gigantic

A GROUP OF QUAINT INSECTS

Brazilian lantern-fly.

British lantern-fly.

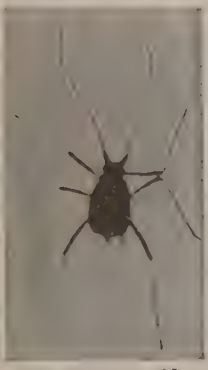
Indian lantern-fly.



Book-louse.

Stick insects on a twig.

Bee-louse.



Rose-tree aphid highly magnified.

Water-scorpion.

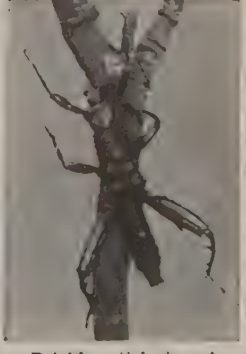
Shield-bug.

Frog-hopper.

Pond-skater.

Water-bug.

Leaf insect.



Prickly stick insect.

company—perhaps ten thousand species are already known—several come into personal contact with us. The loathsome Bedbug, cause of misery, humiliation and disease to human beings, is one of the wingless ones which seem within recent time to have turned from plants to animals and man himself. Cleanliness and care could eradicate this pest from every human home in a year, but there is always the hopeless East to renew supplies.

There are winged bugs, big as bees, in tropical lands. Though not regular inmates of houses, they fly at night into open bedrooms and drink human blood after the fashion of vampires and leeches. The enormous majority of bugs confine themselves to the open and, with carnivorous exceptions, subsist on the juices of plants. Some of them are lovely in outline and coloration, and reveal Nature in her most artistic and ingenious mood in the fashioning of their eggs and nurseries.

Similarity in structure has led to the grouping of enormous numbers of insects under the heading of bugs. This is a pity, for the name is repellent to the mind. So, however, it is, and we can but refer the student to such companies as the shield-bugs, the forest-bugs, the myriad plant-bugs, and equally numerous flower-bugs, and note that our merry pond-skaters and dashing but savage water boatmen, which fly as well as swim, are of the great bug group; as also are the so-called water scorpions, small in our ponds but comparative giants in the tropics. Many of these bugs are capable of emitting a highly unpleasant odor from fluid, a device for their protection against enemies.

THE SINGING CICADA, WHICH IS KEPT LIKE A BIRD IN A CAGE

But we pass now to a related group, the *Homoptera,* in which this displeasing faculty is not present. First among them come the Cicadas, in which the babies live to old age and the adults die young. That seems a paradox, but multiply the figures of the May-fly life and we have the solution of the puzzle.

A May-fly larva takes a year or more to grow up, and the perfect insect mates, lays its eggs and is dead in a few hours. The larva of the cicada lives underground for *years;* then the complete insect comes out and runs its full course of adult life in a few days or, at most, a few weeks. There are many species throughout the world, especially in the warmer countries, and everywhere they are famous for the song produced by the males alone. "Happy are the cicadas," said a sour Greek sage, "for their wives are voiceless." The song of the male cicada is so cheery to some ears that the insects are kept in cages as are birds in temperate lands.

Development takes different periods with varying species. In the southern part of the United States there is one species which requires thirteen years; its more northern relative (perhaps the same species) is the famous seventeen-year cicada.

The eggs may be laid on the forest verge of a field, and there for seventeen years the wingless larvæ live in subterranean darkness, sucking the sap of roots and grass. Finally they emerge, winged, to find that a town has risen on their city—a house, shop or factory on their nest.

THE CICADA THAT LIVES IN DARKNESS FOR SEVENTEEN YEARS

After all this long preparation the adults make their honeymoon excursions, and then settle down on twigs to deposit perhaps five hundred eggs for each robust female. Immediately afterward they die. The eggs hatch into larvæ, which forthwith burrow down into the soil and remain, the world forgetting, by the world forgotten, till the earth and its family have grown seventeen years older. This is the longest known period of youth outside the mammals, and there man and the elephant alone take longer to attain complete maturity.

It is strange that, while the cicadas so long avoid the light, their kin in the tropics, the gorgeous Lantern-flies, so love the light that they are said to carry lamps of their own creation and fill the night with gorgeous splendor.

The head is shaped like a lantern, and while most species are not known to give light, Sir G. H. Knibbs states that those which do yield light have an enormous advantage over man-made illumination. Whereas our very best artificial light wastes all but four per cent of its energy in useless heat, the luminous lantern-fly has an efficiency of 99 per cent.

The Frog-hopper, or Froth-fly, which punctures vegetation, turns the sap to frothy bubbles and lives in them as in a

FLOWERS AND THEIR VISITORS

There is a wonderful partnership between plants and insects, the flowers supplying the insects with food, and the insects carrying the pollen from plant to plant to fertilize the ovaries and produce seeds. In these pictures some examples of how plants and insects work together are given.

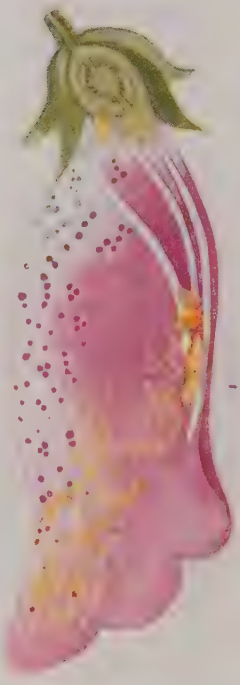
A honeysuckle blossom with a humming-bird hawk-moth approaching it, attracted by the scent. The tubes of the flower are half full of nectar, and to reach this the moth puts out its long tongue.

A young honeysuckle nower with the stamens erect and the pistils depressed. One corolla, or tube, is shown in section, and we see the moth sucking nectar with its long tongue, while the head and wings are being dusted with pollen from the anthers. As the moth flutters it shakes the pollen on to its body.

We have here an older flower with the pistils erect and the stamens depressed. As the moth sips the nectar the pollen from another plant is dusted on to the pistil, where it fertilizes the ovules and produces seeds. As the flower matures the corolla, or tube, curls back from the pistils and stamens.

This spike of foxgloves shows the buds and flowers in various stages of development, with bumblebees visiting them, and also seed capsules.

A section showing first position of long and short stamens.



The longer stamens of an opened flower shedding their pollen.

A bumblebee enters the flower, and the pollen is scattered on it as it gathers nectar round the ovary. The stigma, or part that sooner or later receives the pollen for fertilization, is still closed.

Here the bee that emerged from the last flower is entering another flower, where the stigma is open to receive it, and as the bee pushes past, the pollen is rubbed off on the stigma. The pollen-producing anthers are withered.

The pollen, working down, fertilizes the ovules, which develop into seeds, and here the capsule is bursting and the seeds are pouring out.

The wild arum, or cuckoo-pint, with its spathe and spadix, or fleshy spike. It is a cousin of our jack-in-the-pulpit. Midges creep down the spadix, attracted by the disagreeable smell.

This spathe is cut open to show the midges covered with pollen from an older plant, entrapped by a palisade of spikes. As the insects fly about, the pollen is rubbed off on to the stigmas at the base of the spadix.

This magnified view shows a midge pollinating the stigma, after which nectar is given out by the stigma. One tiny pollen-grain is sufficient to fertilize the ovary below the stigma.

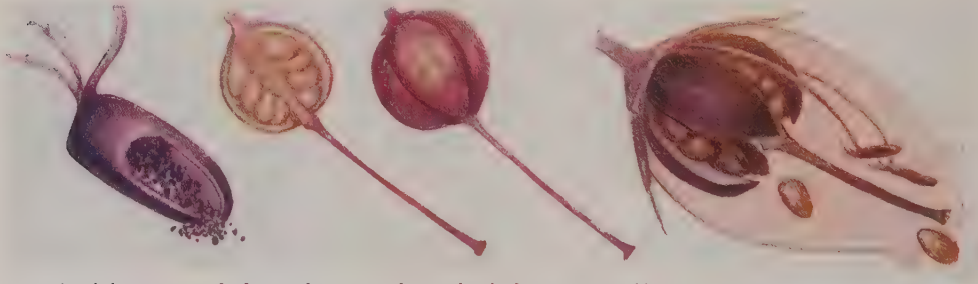
The ovules, having been fertilized, are growing larger. The purple anthers have now burst and are shedding their golden pollen on the midges.

The midges being loaded with pollen, the palisade droops, allowing the insects to escape. They go off and visit another plant, repeating the process.

The ovules, being fertilized, develop into the familiar red berries known to country children as lords and ladies. They are the fruits containing the seeds.

This picture shows the beautiful bell-shaped flowers of the heath, and two meadow brown butterflies flying round them. The butterfly on the left is a female, and that on the right a male

Here one of the flowers is cut open and greatly enlarged so that we may see what goes on when the butterfly pushes its tongue down to the nectar. It already has pollen on it from another flower, and this is dusted off on to the ripe stigma, fertilizing the ovules, while the stamens are disturbed, and the pollen pours out from little holes on to the butterfly's head.



On the left is one of the anthers on the end of the stamen, magnified, and the pollen is pouring out. In the centre is a section of the pistil with the fruits developing, and on the right we see the fruit, consisting of a capsule with four cells.

Here we see a flower cut open to show the capsule after it has been split, dispersing the seeds to continue the race of heaths.

castle, is a close relative of the lantern-flies; and close on their heels in the table come the Plant-fleas—little winged creatures which use their pinions to help their leaping about the plants which they bore and suck. And then come the chief criminals of the rose garden, the Aphids, or Plant-lice.

The cost of flowers and of food may be fixed by these little villains. We find them on roses and other flowers; on fruit trees in the form of the woolly aphid; on vines as phylloxera; on potatoes, cabbage, beans, hops; on important timber trees. Their life-story is marvelous, for the plant-louse arises from eggs in spring, but is produced alive by its mother in summer. So terribly rapid is the rate of reproduction and so fertile are the insects that, as Huxley has shown, if ten broods from one aphid came without hurt to perfection, that tenth brood would weigh more than 500 million stout men! They can drain the life out of the vegetation of an entire countryside.

Our chief natural defense against them are birds, ladybirds and ichneumon flies; but these are terribly insufficient, as we often see. When the early months of the year are too cold for ladybirds to appear, but not for plant-louse, or when for any other reason, the insect enemies of these plant-lice are not relatively abundant, vegetation of all sorts has the life-sap drained through the tiny beaks of these multitudinous creatures.

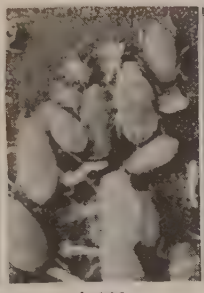
Cicada.

Corn-thrips.

Springtail.

Cochineal insects on a cactus.

Male cochineal insect.

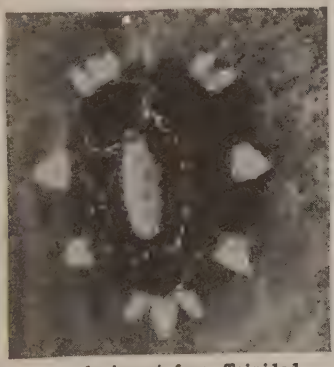


Aphids on a leaf.

Plant-bug of the garden.

Termite, or white ant.

Woolly scale insects on a plant.



A scale insect from Trinidad.

Brown currant scale insects.

THE LIVING SUCTION PUMP WHICH TAKES THE JUICE FROM THE GRAIN

One of the plant-louse family, the grain aphid, attacks our growing corn, taking into its greedy stomach the fluid which should fill the ear with grain. But we must not attribute every shriveled ear of corn to the aphid, for there are other

enemies at work there, notably the Corn-thrips. This is a tiny marauder belonging to the *Thysanoptera,* a little living suction pump which drains the young grain and prevents it from developing. Others of the family attack the pollen of flowers and make the formation of seed impossible.

Somewhat resembling them are obscure little insects, the *Thysanura,* of which the Springtails are perhaps the best known. They are the little people of stagnant waters and damp, mossy places, warm or cold. Some give a thrust with their active wonderful little tails and leap from the surface of the water into the air; others peep out at us when we raise a flower-pot. To others the under-side of a small stone is all their world, while yet others, known as the glacier-fleas, are heroically at home where air is frosty and water is turned to ice, high up the Alps and other mountains.

THE LITTLE RED-JACKETS AT WAR IN CALIFORNIA ORCHARDS

They seem harmless enough, but a similar certificate cannot be awarded, save with exceptions, to the Scale Insects. These are little creatures in which the young and the females look like oval scales growing on plant life. In reality they are attached by their suction apparatus to the growth, draining away its life-juice.

Small, but enormously numerous, they infest orange, apricot, olive, peach, fig and other fruit trees, as well as all manner of precious shrubs. Some years ago scale insects from Australia, relatively harmless at home, were accidentally introduced into the great fruit orchards of California. They spread like a fire, and the whole fruit industry of the state seemed doomed to destruction.

Scientists went to Australia, however, to see why the scale insect did so little harm there. They found that it formed the food of various insects, notably of the ladybird. So the enemy of the scale was carried to America and liberated in the orchards. The plan was entirely successful, and to-day the United States Government keeps millions of ladybirds as natural police, just as she keeps an army and navy.

There is some good in nearly every Order, and we find it even among the scale insects. For the Lac Insect, from whose product we make sealing wax and the finest material in our varnishes for cars and carriages, is a scale insect, and so, too, is the cochineal insect. This has been from time immemorial the source of a beautiful coloring matter, though no longer so important as formerly.

The Cochineal Insect is a parasite of certain cactus plants, on which it feeds exclusively. It was gathered with profit till coal-tar dyes came to give us cheaper material. Cochineal-farming seems to be a ruined industry; but it must have been rather a tedious business collecting over 70,000 of the insects to make a pound of them.

HOW NATURE'S SCAVENGERS HELP TO KEEP THE EARTH CLEAN

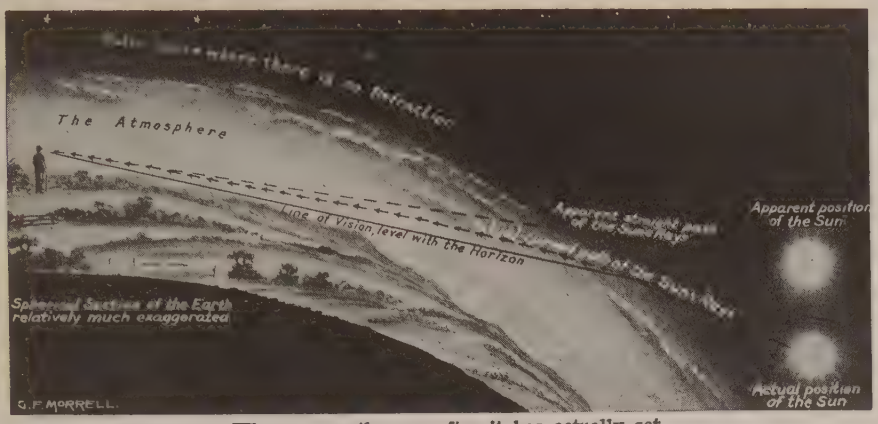
So much, then, for a hasty opening glance at the insects. There are many of them that we have reason to fear, and we may wonder why they exist. Their rôle is plain. They are scavengers, they are harvesters, they are the agents down whose throats is meant to disappear excess of vegetation in the world. Without them the earth would become rank with overcrowding in every phase of the botanical kingdom. We have appeared on their horizon, on their preserves, to share, or else to claim entirely for our own use, the things they desire.

The one thing the animal world never provided for was the civilization of man and his processes in taming the wilds. He and it have come; the older inhabitants, the insects, are still in possession where we pioneer and settle down. They continue as they began, so their war with mankind is inevitable.

Most of the larger forms of animal life tend to disappear with the presence of man unless he preserves them for his own purpose, as for example, cattle. The buffalo is almost gone, the elephant has become scarce. Most of the fur-bearing animals are growing rare. Some birds have disappeared entirely, while others are few in number compared with the past.

This is not true of insects. Some scientists fear that they are gaining on mankind, and that perhaps some day they will get the upper hand. It is estimated that they now eat every year between one-fifth and one-fourth of our crops. We have destroyed the birds, their worst enemies, and we plant every year millions of acres of just the foods they like.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6221.


The Atmosphere
Line of Vision, level with the Horizon
Apparent position of the Sun
Spherical Surface of the Earth relatively much exaggerated
G. F. MORRELL
Actual position of the Sun

Why we see the sun after it has actually set.

WHERE COLOR COMES FROM

CONTINUED FROM 5812

WE may now consider one of the most marvelous and mysterious things in nature—the wonderful colors that we may see in light. The color of light is its pitch, and as we follow the colors of the spectrum from red to violet it is as if we were listening to someone playing an octave on the piano. In the case of sound we know that many notes really consist of more than one note, though it is possible, of course, to have notes made up of waves all occurring at the same rate. A tuning-fork produces such a note, but the violin, or a piano-string, or the human voice, produces a note made up of a mixture of different pitches.

It is possible, as in the case of sound, to have light which is made up of waves of one pitch, or light which is made up of any kind of mixture of waves of different pitches. Different colors vary in the variety of waves of different pitch that they are made up of, and the eye usually takes these forms into consideration when, as we may say, it likes or dislikes certain colors. Let us, then, remember that color is the pitch of light, just as we may say that pitch is the color of sound.

We know that when we look at the spectrum, though the various colors pass gradually into one another, we see there a small, definite number of certain colors which we can name and number. We must clearly understand, however, that this appearance is due only to the particular way in which our minds are made. Color depends really on the number of waves in a second. Within the limits of our seeing, the exact number of waves produced in a second may be anything, and every one of these rates really means, if only our eyes could see it, another color. There are thus actually countless millions of colors, though our eyes can see so few of them.

Just as the number of waves made in a second varies, so also does the size of the waves. The proper name for the size of waves is wave-length, and the rule is that the longer the wave-length, the fewer is the number of waves that occur in each second; and the shorter the wave-length, the more frequent are the waves. Of the light that we can see, therefore, the dullest, a red that is almost invisible, has the smallest number of waves in a second and the longest wave-length, while the violet is made up of the quickest waves and has the shortest wave-length.

Of course we must not confuse the number of waves in a second with the

rate at which the light is traveling. A tall man with very long legs and a boy with short legs may be running side by side at exactly the same rate, but the boy may be taking three strides to the man's one. In the same way, all the kinds of light travel at the same rate, but the waves of violet light correspond to the boy's short, quick strides, and the waves of red light to the long, slow strides of the man by his side.

WHY THE CAMERA CAN SEE THINGS THAT GIVE US LIGHT AND ELECTRICITY

The study of the wave-length of light is very interesting because it bears on the question as to how small are the things that we can see. The size of the wave-lengths of light is so small that tens of thousands of light-waves could be put side by side within an inch. Now, when it comes to trying to see very tiny things with the microscope, the question of the wave-length of the light we are using is very important. The shorter the wave-length, the nearer together may two points be which, seen by such light, will be seen separately. But they may be so near that, if afterward looked at by light of longer wave-length, they cannot be seen separately, but are seen only as one thing. So, other things being equal, it may make all the difference to what we see whether we are seeing objects by means of yellow light with a rather long wave-length, or by means of blue light with much shorter wave-length.

The trouble here is that our eyes are more sensitive to the rays of longer wave-length, which are, for that reason, so much the worse for seeing tiny things by. Of the plate of a camera, however, just the reverse is the case. It is much more affected by waves of short wave-length than by those of long wave-length. So, where our eyes fail, the camera can, to a certain extent, be used together with the microscope to see, by means of violet light, things so tiny that they could be seen in no other way.

Below the red rays there are, as we know, the rays of invisible heat. These also vary, just as the rays of visible light do; and a great student of the subject has made wonderful discoveries about them. These rays cannot be seen; and when rays cannot be seen they can be studied only in some other way. They can be studied, for instance, by means of the heat they produce; and so S. P. Langley, whose early airplane now is seen in the National Museum at Washington, invented a marvelously delicate instrument known as the Bolometer which is really nothing more or less than a thermometer, but vastly more delicate than the best of ordinary thermometers. By means of this instrument scientists have been able to study heat-waves in detail and have shown that they differ from each other, and, indeed, make up a long spectrum like the spectrum of visible light.

THE KEYBOARD OF INVISIBLE WAVES THAT GIVE US LIGHT AND ELECTRICITY

The one is, of course, a continuation of the other. This spectrum, too, contains lines and places which correspond to the dark lines that can be seen in the spectrum of visible light. Similarly, there are octaves and spectra of light of which the waves are too short to be seen, and which, because they are of shorter wave-lengths than the violet rays, are called the ultra-violet. The waves become shorter and shorter till the X-rays are reached. This discovery was very important and explained many things.

This wonderful keyboard of waves extends still farther below the heat rays. The lower waves are slower and bigger. We know them best by their electrical properties, for they are electric waves—the waves that run along the wire of a telegraph or telephone, and the waves, needing no wire, which are used in wireless telegraphy. It is important for us to understand that simply by moving down the keyboard from visible light we come to the waves that make an electric current.

Now, this can only mean that light and electricity are as like each other as the sounds produced by the middle octave of a piano and the sounds produced by the notes near the bottom of the piano. We rightly use the one word, sound, to describe both of these things, for they are really the same. We might say, then, that electric waves are really light-waves which we cannot see, but this is not the best way of putting it. The best way is to speak of the electric theory, or the electromagnetic theory, of light. This theory simply means that light is a kind of electricity. All these waves that travel at the same enormous speed are really of one and the same kind, and the only word that describes them is the word electric.

LIGHT-WAVES THAT EXCITE THE EYE, AND WAVES THAT EXCITE THE SKIN

It so happens that we possess in our bodies eyes which have the power of being excited by about one octave of these electric waves; and to that octave we give the name of light. It is really electricity. Other electric waves which happen to be longer, and of which fewer happen to be made in a second, affect us in a different way. They do not excite our eyes, but they excite our skin and perhaps make us jump.

Electric waves, including the waves of light, move in straight lines, all of them at a known speed. Just as in the case of sound, or the power of gravitation, or the power of magnetism, the intensity of light becomes less very quickly as we pass away from the place where it is made. The rule is that at twice the distance it has one-fourth the intensity; at three times the distance, one-ninth the intensity; and so on. In other words, the intensity of light, like the intensity of all these other things, varies inversely as the square of the distance.

THE LAWS THAT HOLD GOOD FOR LIGHT AND SOUND AND RADIANT HEAT

As in the case of invisible or radiant heat, some substances admit light, others soak it up, or absorb it, and others will reflect it from their surface. No one can yet explain what are the differences in different kinds of substances which make them behave in these different ways when they encounter light.

Some things we do know. One is that when light is absorbed it is not destroyed, for we know that nothing is ever destroyed. What eternally happens everywhere, inside our bodies and in the great world, is not destruction, but transformation into heat. That is only another way of saying what we all know so well—that things which the sun shines upon become hot, especially if they are dark things. We know, also, that when substances let light through them, the light waves travel through the ether in the substance in question—as, for instance, through a pane of glass. But however transparent a thing is, it does not let through all the light that comes to it. This is true of a pane of glass, however polished and smooth, and it is true of the beautiful front parts of our eyes.

The proof that these things are not quite transparent is plain, because, if we go about it in the right way, we can always see little reflections from a pane of glass, as when a train is in a tunnel, or from the surface of other people's eyes. These reflections mean that light has been reflected to our eyes, and therefore that the thing is not quite transparent.

Although we do not know why one thing reflects and another does not, we can learn the laws of reflection. These laws really hold good, not only for light, but for radiant heat and for sound; and everyone who has played billiards or who has thrown a ball against a wall knows something of the laws of reflection.

We know that if we throw a ball straight at a wall, it comes straight back to us; if we throw it sidewise, it goes sidewise, and it comes off just as much sidewise as it was thrown sidewise. If a ball on a billiard table is rolled gently against the cushion at an angle, it will come off again at the same angle. The angle at which the ball approaches the cushion is called *the angle of incidence,* and the law for the billiard ball, for light, and for all these other cases, is that the angle of incidence and the angle of reflection are equal.

HOW THE EYE AND THE MAGIC LANTERN ALTER THE COURSE OF LIGHT

There is another thing which happens to light, as it does also to radiant heat and to sound, and it is called *refraction.* We must always distinguish this word from reflection, which means "bending back." Refraction means "breaking back." When a ray of light passes from one thing to another it is always broken, or refracted, and this refraction also has laws. It is extremely important, for we are able to see things only by means of refraction. The whole of the front part of the eye is really a wonderful piece of machinery for refracting the rays of light that come in so that they shall all be made to fall on the retina, or curtain, at the back of the eye in such a way as to produce a clear image of the thing we are looking at. Eyeglasses of every kind are used for the same purpose. The use of them all, and of every kind of microscope and telescope, is due to their power of refracting the rays of light.

Different things have different powers of refracting light. The diamond, for instance, alters the course of the rays of light passing through it much more than water does, this being the reason why the

diamond is such a brilliant gem. But the rays of light themselves differ in their power of being refracted; and refraction is the key to Newton's great experiment. His prism was simply a means for refracting the rays of light passing through it, and the success of his experiment depended on the fact that the different kinds of light are refracted to a different degree in a regular way. The existence of the spectrum depends entirely on refraction. This is an interesting fact to remember.

WHY WE NEVER SEE THE STARS EXACTLY WHERE THEY ARE

If we ask why rays of light are refracted when they pass from one thing to another, a partial explanation can be given. It is that the speed of the light-waves is slightly altered when they travel through a different substance, and the different waves are differently affected. The simple rule is that the denser the subject through which the light is passing, the more it is retarded. It may here be added that the facts of refraction can be understood on the theory that light travels in waves, but have been found difficult to explain otherwise—if, for example, light is supposed to travel in specks or corpuscles.

When the light traveling through empty space reaches our air it is slightly retarded and bent. A consequence of this refraction produced by the air is that we see no heavenly body where it really is, but at some spot at a little distance away; and we can actually see the sun when it is below the horizon because the rays are refracted as they pass through the air. When passing from air to water light is refracted yet more, and the explanation of the fact is that light-waves travel slightly more slowly through water than through air, because water has greater density than air.

HOW COLORS ARE PRODUCED BY REFLECTION

We have seen how refraction produces color by splitting up white light. But there is a way in which reflection also produces color, and practically all the color of the world is produced by reflection. It is true that sunlight has its own color, for, though we call it white light, it is really rather golden; and it is true, also, that luminous things, like flames and fires, have colors of their own, because the light they produce has a high proportion of red or yellow or green or violet rays. But, apart from that, the earth and the things on it have colors, though they are not themselves luminous; and these colors are produced by reflection from the white light that falls on them.

THE DIFFERENCE BETWEEN LUMINOUS AND NON-LUMINOUS THINGS

This reflection of theirs is *selective,* as we might say. A white thing does not select; it is white just because it does not select, but reflects all the waves of light which happen to fall on it. Not being luminous, it makes and creates nothing, but it will simply reflect whatever light falls upon it. If we throw red light upon it, it will be red; if we throw upon it a mixture of lights called white, it will be white. This is the great difference between the things that are not luminous and the things that are.

The things that are not luminous but do appear to have color are those whose surfaces, in reflecting light thrown on them, select certain constituents of the light, or certain wave-lengths of it, for their purpose. Thus, a substance appearing red under white light is one which has picked out the red wave-lengths of light to reflect.

WHY A PIECE OF BLUE CLOTH LOOKS BLACK IN A RED LIGHT

Again, if a piece of blue serge is put into red or orange or yellow light it appears black. In blue light it looks blue, in violet light it appears violet, in green light it would seem to be green. All this is because its surface cannot reflect red or orange or yellow, but can reflect green or blue or violet. When white light, a mixture of all these colors, falls on it, it absorbs some of the waves and practically destroys their effect, but it reflects on to our eyes others of the waves, blending them so as to produce to our vision a blue effect.

There is another department of the study of light about which huge books have to be written. It deals simply with rays of light and the laws of their bending. This requires a great deal of mathematics, and is called mathematical optics. To this subject, also, there is no end, and it is very important, because it underlies everything that we do and shall do with microscopes and telescopes and all the other different kinds of optical instruments. We do not yet know all about this fascinating subject, but our knowledge of it is increasing.

THE NEXT STORY OF THE EARTH IS ON PAGE 6313.

The magnificent panorama of the Alps as seen from Mürren.

AMONG THE SNOW-CAPPED ALPS

A FAMILY TOUR IN SWITZERLAND

CONTINUED FROM 6010

THERE are two thrilling moments which boys and girls never forget. One is a first glimpse of the sea, and the other a first sight of high mountains. No words can really describe either, but the impressions made on the heart and mind never fade away. We shall not forget the first time we crossed the Atlantic to have a holiday in Switzerland. People had talked about the Alps for hours, and we had drawn upon our imaginations for pictures of what we expected to see. But looking backward when our trip was over, we knew that our imaginations had failed us. Without seeing them no one could even guess at the majesty and grandeur of the Alps.

We were a merry party at breakfast our first morning at Berne, in spite of a stormy Atlantic crossing and a long night journey across the plains of France. Our spirits had begun to revive when the wide, sad plains—so inexpressibly lovely in the misty gray dawn—gave way to the uplifting hills of the Jura country which ushered us into Switzerland. Watching the hastening rivers and the fleeting woods and valleys—foretastes of delights to come—we felt that a magic journey was before us.

Once upon a time someone said that the Alps were the frame in which the beauties of Berne were displayed. And while we were in the city looking up to the fringe of snow-capped peaks the saying seemed true. In the town itself the thing we wanted to see first was the Bear Pit! This Pit is world-famous because it is the living coat-of-arms of Berne. Other cities have coats-of-arms in marble or metal, but Berne is probably alone in keeping alive its heraldic bears. All day long visitors are entertained by the lazy, greedy, good-natured and clownish animals in the inclosure. Crossing the river and passing through the arcaded streets, we came to the ancient Clock Tower, with its curious moving figures.

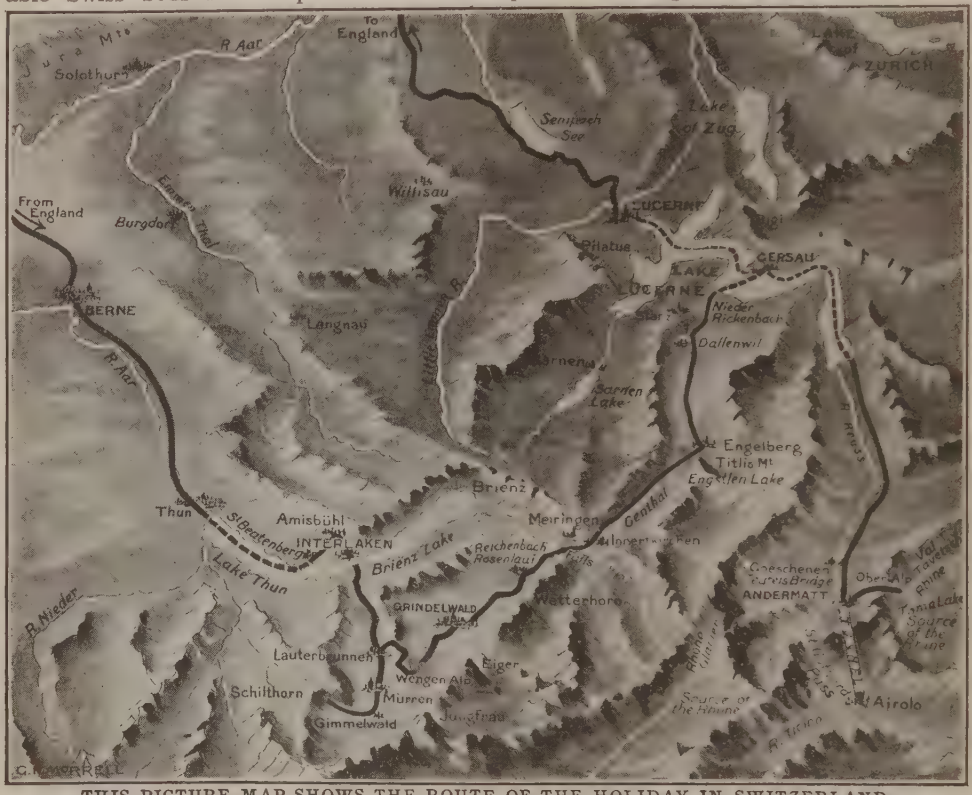
The sun was shining, and we had no eyes for anything but the views from the promenades or from the high bridge across the swiftly flowing Aare. Then we mounted the grand terrace on which the great church stands boldly out over a hundred feet above the river. Our next move was up the Schänzli, a hill close by, where we had our first out-of-door meal.

But the view! It was our first sight of the distant glittering white mountains, of which we had so often read. They seemed to us, as we gazed, a sort of link between earth and heaven, rising from the lower hills to mingle with the clouds of the sky above. A

mighty company of giants they looked, those chief peaks of the Bernese Oberland, or Highland. As we gazed at the Jungfrau and her neighbors a beautiful rosy flush spread over their unearthly whiteness; it was the sun's good-night kiss. And then we began to feel tired, and gladly took the electric car home to supper and to our delightfully comfortable Swiss beds in our pleasant hotel.

closer, and on Lake Thun new beauties were unveiled at every turn as the steamer to which we changed passed almost under their shadow.

At Spiez the lake was crossed. On the steamer someone told again the old story of the time when Spiez was Paradise. The legend is that Rudolph II, king of the Burgundians, built a wonderful palace at Spiez on the edge of the lake. It was so



THIS PICTURE MAP SHOWS THE ROUTE OF THE HOLIDAY IN SWITZERLAND

GLIDING ON THE BEAUTIFUL LAKE OF THUN

In the morning a call was made at the Natural History Museum to see the relief map of the Bernese Oberland. We wanted to compare it with our flat ones, tracing on it the valleys and passes we had planned to see, for our trip was to be made on foot as much as possible. While in the Museum a hurried glance was taken at the beautiful crystals from St. Gothard and at the animals of Switzerland. And then, having sent on in advance all the heavy baggage, we shouldered our knapsacks packed with necessaries for the night, and rushed for the train to Thun. The wonderful mountains came closer and

marvelous that the country folk called it the "Golden Court." The neighborhood came to be called the "Golden Air" and then it became known as Paradise. This story was one of the famous ones sung by the troubadours.

All too soon came the little landing pier, from which a mountain railway took us up a very steep mile. Every moment the view became grander and grander. As we left the station and started our walk along the road cut out of the Beatenberg Slopes, somehow we thought of Jack climbing the beanstalk and the wonderful country he found at the top.

There were woods rising on the left, woods and fields sinking downward to

the lake on the right. The long village of St. Beatenberg straggled along this road for two or three miles, with large hotels, and little shops full of carved bears and other Swiss articles. On and on we went, past the last big hotel, and then up more hill, till we were nearly a thousand feet higher than the village and had arrived at Amisbühl.

A SWISS MOUNTAIN VILLAGE—AMISBÜHL

All our lives we can never forget our week at Amisbühl. From the deep veranda we looked right across Interlaken—the town "between the lakes" of Thun and Brienz—to the glorious mountains that seemed to call us all the way from Berne. We studied them at every hour of the day, in all sorts of weather, and found them always changing in color and beauty. With the telescope we saw climbers like black specks, and many details of the rocks, snow and ice that make up a snow landscape.

The ancient city of Thun.
© Underwood & Underwood, N. Y.

A THUNDERSTORM IN THE MOUNTAINS

The grandeur of it all in a great storm of thunder and lightning was startling. The thunder crashed and rolled and muttered, and its echoes were tossed back and forth from mountain to mountain. Never had lightning revealed to us such desolation for such brilliant moments! And sometimes, when the mists covered the lake and the town far below, and the valley beyond, we wondered if they could really be there, for we could see nothing below the billowing gray sea. While we were still bewildered the scene suddenly changed. All below was golden sunshine and bright color, and the mists had rolled up to hide the peaks.

On the Lake of Lucerne.
© H. C. White Co.

We got into the habit of waking early to watch from our windows the glories of the sunrise. Each day of our stay we took beautiful walks up the hills, and soon succeeded in climbing up the slippery grass slopes to see over the ridge to the valley beyond. Charming white goats came and played with us, and shared the salt we had brought to eat with our hard-boiled eggs. Milk was obtained in the chalets of the high pastures on which the beautiful brown cows wandered, loud bells fastened round their necks jangling at every step. All too soon the day came to leave. Our bags were sent on to Mürren, and in the morning we again shouldered our knapsacks. We found our way past the haymakers—they always seem to be making hay in Switzerland—and the barns, and the chalets. Down and down went the path through the woods for three thousand feet to the lake, and Interlaken—the town between the lakes.

Some of us would have liked to linger in the town, for the shops were most tempting, but we pushed on by train up the valley to Lauterbrunnen. We mounted all the time, and enjoyed the sight of the hurrying, foaming river beside which the railway line climbs up the mountainside. The ever changing views of the snow giants now seemed close upon us. The cable railway and the electric railway led up to Mürren, but it was decided to make the climb. Part of the way was hot and shadeless, but farther up there were little leaping rivers to cross, besides all the delights of shady, mossy paths and wild strawberries. Then we gloried in the cool, sweet breezes.

LIFE ON A MOUNTAIN PLATEAU IN SWITZERLAND

When we came out, somewhat tired and heated, on the plateau on which Mürren stands, we felt overwhelmed by the nearness and immensity of the mountains, divided from us by a narrow, deep valley. What a glow there was upon them that evening! Everyone rushed out from dinner to enjoy the sight for the few minutes that it lasts. And from our window the goats could be seen coming down the lane from the mountains to sleep in the village. We heard their bells again in the morning when they started soon after the glorious sunrise. Some days were spent at Mürren, two as wet as wet can be. No views, no fires, no little girls and their mothers at every corner making lace for tourists to buy, were to be seen. But we read up our route, wrote our letters, and on fine days enjoyed our walks all the more for a rest.

Swiss peasants at breakfast.
© Underwood & Underwood, New York.

Such walks! Each day we found a more beautiful one than the last. But the unforgettable one was to the Schilthorn, our first big climb. The path led up and up, to a dreary valley all rocks and snow. The sun had melted the snow, and as we crossed it we sank in over our boots. But beyond the snow was a field one blaze of blue—dark blue gentian, pale blue forget-me-nots, and below a blue, blue lake; while above, over all, the bluest of skies. There was a fine scramble back, tobogganing part of the way, and much enjoyment crossing a wide and dashing river on stepping-stones. It was great fun standing on a stone with the river foaming all around.

The upper glacier at Grindelwald.
© H. C. White Co.

THE BEAUTY OF SWISS WOODS AND WATERFALLS

The next part of our holiday was another glorious walk. Leaving Mürren early in the morning, packs on back, baggage sent on to Nieder Rickenbach, we took the road for four or five days. Past Gimmelwald, down and down to the head of the Lauterbrunnen valley went the road. And all day long we realized to the full the meaning of its name "nothing but springs." Torrents rushed down the steep sides in great leaps, or fell sheer over hundreds of feet. Rainbows glittered on the thin veil of mist made by smaller falls. And the path through the woods ever twisted and turned as if to disclose new beauties at different points.

Presently we found ourselves at the foot of a high cliff, with one of the hotels at Mürren perched on the very top of the height. On the other hand were the steep slopes leading to the Jungfrau mass. A little way up this slope the Tummelbach Falls rushed magnificently through rocky chasms in the heart of the mountain. Peeping into these chasms, sheltered from the spray by umbrellas provided by little boys on the spot, we saw the mass of water shoot out in one wild bolt into midair, to fall in a rushing stream below. On the way down the valley a delightful Swiss schoolmaster told us of the school he taught in New York, and of the interest of Zurich, where he lived. His powers of walking were astonishing. Regretfully we had to say good-bye, and we saw him swing on toward Interlaken. Our stop was to be at Lauterbrunnen, at the point

in the valley where we started our climb. A bigger climb was in store, up the Wengern Alp and to the top of the pass of the Little Scheidegg. But it was decided to do it by the railway, which winds upward through meadows and pine woods, over bridges, and through tunnels.

The views became grander and wider as we went up and up, over the Lauterbrunnen valley by which we had come, to Mürren and the mountains behind. The overwhelming nearness of the glaciers and the immense and dazzling snow mountains, now only two or three miles away, was bewildering. The wonderful train with powerful engines appeared and disappeared on its way through tunnels in the Mönch, Eiger and Jungfrau until it reached far up the Jungfrau. We spent the rest of the day exploring the various points of view. The valleys below opened out surprisingly, showing green meadows dotted with flowers. Scattered about were brown chalets roofed with shingles kept in place by huge stones. Across the valleys on distant mountain slopes could be seen roaring waterfalls, mysterious forests and threatening rocks. It was unforgettable beauty. Unwilling to leave this wonderful ridge, whence our onward route could be seen through Grindelwald to the Great Scheidegg beyond, we stayed another day and night on the top. We climbed the Lauberhorn, and spent hours drinking in the wild beauty of the entire chain of this Bernese Oberland, which we first saw so distant and ghostlike from Berne. Distance did not need to lend enchantment in this case. The nearer view was perfect.

The village of Grindelwald.
© Underwood & Underwood, New York.

A VISIT TO THE GLACIER AND THE ICE GROTTO

It was like a descent into another world, next day, to pass through noisy Grindelwald, with its crowds of tourists and vehicles, shops and hotels. So everyone was glad to push on toward the beautiful three-peaked Wetterhorn and spend the night in a hotel an hour or so beyond Grindelwald, near the Upper Grindelwald glacier. A visit was paid to the Ice Grotto cut out in the thickness of the ice. The boys and girls of our party found great interest in the blueness of the cracks and in the débris brought down by the ice-river and dropped where it thaws. Next followed a trip in the wonderful train by which we mounted high in air, as in an elevator, and looked far over the sea of ice, with its frozen waves. Far below smiled the valley, with its beautiful pastures shut in by bare peaks and dazzling snow. After vainly trying to make friends with a splendid St. Bernard mother and her puppies, we set out for the pass of the Great Scheidegg. At the top of the pass we got a farewell view of the giants that had made our lives seem fuller and wider, and the world a nobler home.

The descent by the lovely path overshadowed by the Wetterhorn and its companions was quite easy. Now and then we heard the thunder of a falling avalanche and saw the light snowflakes dispersing like a white cascade.

Beds for the night were secured at a sawmill. Next morning, avoiding Meiringen, we found our way past the Reichenbach Falls through the amazing gorge of the Aare to Innertkirchen.

A good night's rest prepared us for the long ascent of the monotonous Genthal next day. In the morning the mist cleared away as we passed the beautiful Engstlen Lake. The majestic Titlis Mountain came well into view as the summit of the Joch Pass was reached. Thereafter began the steep ascent toward Engelberg. We rested for the night at the Hotel Hess, where climbers often stay before starting for the top of Titlis. The view from there takes in all the Alpine mountains from Savoy to the Tyrol, and away to north Switzerland and south Germany.

A young goatherd.

After a passing look at Engelberg in its green valley and at the huge abbey, there was a train trip down to the valley so famous in Swiss history, leading past Stanz to Lake Lucerne. But our stopping-place was Dallenwil, a little roadside station. A three-hour climb by a bridle-path through woods and pastures led to Nieder Rickenbach. There was no road for carriages, so the only way to get there, if one's feet were not strong enough, was on mule-back or in a chair, like a sedan chair, carried by two men. The luggage, the food, the furniture, everything had to be thus carried up. We were glad to see our baggage awaiting us, and to settle down for a week to explore the beautiful neighborhood. All too soon the day came when we had to start again. We sent the baggage to Gersau, on Lake Lucerne, and with knapsacks once more buckled on, we climbed the hill behind Nieder Rickenbach. From the top there was a view of the great blue lake below, and others glittering in the distance. Rigi and Pilatus—grand heights, though not snow giants, were seen in the distance. Then we dropped down to the lake to take a steamer across to Gersau, our headquarters for the rest of the holiday. Many little trips by the steamers and climbs to spots famous for their views filled the flying days. The longest and last trip was to the very end of the lake, and then by train to Goeschenen. This railway, so wonderfully engineered, rose by circular loops and tunnels to the levels required. As we had always longed to go in a real Swiss coach, which looks like three carriages built into one, we took the Ober-Alp coach from Goeschenen. A glance into the black mouth of the tunnel that pierces the heart of the great central mountain mass of St. Gothard, then the coach rumbled over the Teufels Bridge, and past the interesting fortifications which guard the passes. On the passes were the soldiers returning from their practice in carrying guns in pieces on mule-back up the steep hills—all for defense, not attack. And the coach with its five horses rattled on past Andermatt, then up and up by zigzag roads, backward and forward dozens of times. The view became more and more magnificent. At last, when the lake at the top of the Ober-Alp Pass was reached, we scrambled down, rather stiff, to stay the night at the little hotel. The horses now had a descent as steep and long as the ascent we had just made, to the lovely Val Tavetsch. Through this valley the infant Rhine starts on its long journey to the distant North Sea.

A mountaineer with a captured eaglet.

It was to see its very beginning that we went to the Ober-Alp. The disappointment was great next morning when it rained hard. However, a stiff bit of climbing brought us to within five minutes of the little Toma See, or lake, called the "source of the Rhine." Then suddenly there swept down a thick mist, which wrapped us round with cold, wet arms and blotted out even the nearest rocks and trees. There was nothing to do but to beat a hasty retreat, walking as carefully as we could. The coach brought our party back to Goeschenen and thence to Gersau, to find the lake a mass of glittering purple and gold under a stormy sunset. Two pouring wet days made us feel less unwilling than we had been to leave the beautiful holiday country. It had already withdrawn from our eyes under a mantle of gray mist. It was decided to take the steamer from Gersau to Lucerne. In any case, we could not leave without at least a glance at Lucerne. Fortunately, by next morning the weather had cleared. Walks on the quays under the chestnuts, the views on the lake, the pleasant bustle and the rushing green torrent of the Reuss pouring out of the placid lake, crowded the hours. The old bridges with roofs were interesting. So were many beautiful old houses, with their signs hanging out, as was the custom in the Middle Ages. We saw the famous dying lion hewn out of the rock, his paw sheltering the lilies of France. That recalled the tragic story and the bravery of the Swiss Guards who defended the Tuileries to the death. There were tempting shops, with presents to take home, in the shape of silver jewelry, painted ivory flowers, and the ever charming carvings made by our little brown friends at Berne. But before we said farewell there was a view that must be seen. Electric and cable street cars took us quickly to the Sonnenberg, a height behind Lucerne. There we spent a lovely afternoon saying good-bye to the lakes and mountains which we had learned to love so well. Then came the final start, from Lucerne, for London. As we went we made plans for another visit when we crossed the Atlantic again. And the next time we hope to see the Holbein drawings at Basel and the old houses at Lucerne, to continue the journey in the Ober-Alp coach, and perhaps to try again to see the source of the Rhine. Or perhaps we shall see the country in winter dress.

† A village street.

*The village fountain.

*A Swiss reaper.

A giant alpine horn.

† A little lace-maker.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6191.

*© Underwood & Underwood, New York. †© H. C. White Co.

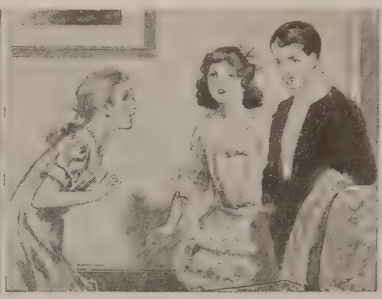
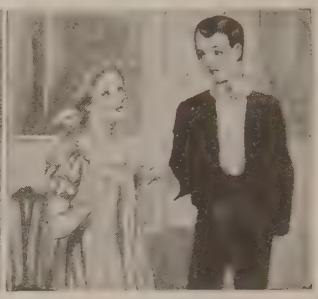
FRENCH—WE GO TO A PARTY

First line, French; second line, English word; third line, as we say it in English.

Hier nos cousins ont donné une fête. Jeannette et moi nous étions invités.
Yesterday our cousins have given a fête. Jenny and I we were invited.
Yesterday our cousins gave a party. Jenny and I were invited.

Jeannette portait une robe de soie et des souliers blancs. Elle était très belle.
Jenny wore a robe of silk and some shoes white. She was very fine.
Jenny wore a silk dress and white shoes. She looked very grand.

Nous sommes arrivés à la maison. Elle était illuminée du haut en bas.
We are arrived at the house. She was illuminated from the top in bottom.
We arrived at the house. It was lighted up from top to bottom.

Dans le salon nous avons trouvé quelqu'une que nous avons reconnue.
In the drawing-room we have found someone whom we have recognized.
In the drawing-room we found someone whom we knew.

C'était Annette. Je l'ai invitée à danser. Elle a mis la main dans la mienne.
This was Annette. I her have invited to dance. She has put the hand into the mine.
It was Annette. I asked her to dance. She put her hand in mine.

La salle était décorée de fleurs. Ma cousine a donné une rose à Jeannette.
The room was decorated with flowers. My cousin has given a rose to Jenny.
The room was decorated with flowers. My cousin gave Jenny a rose.

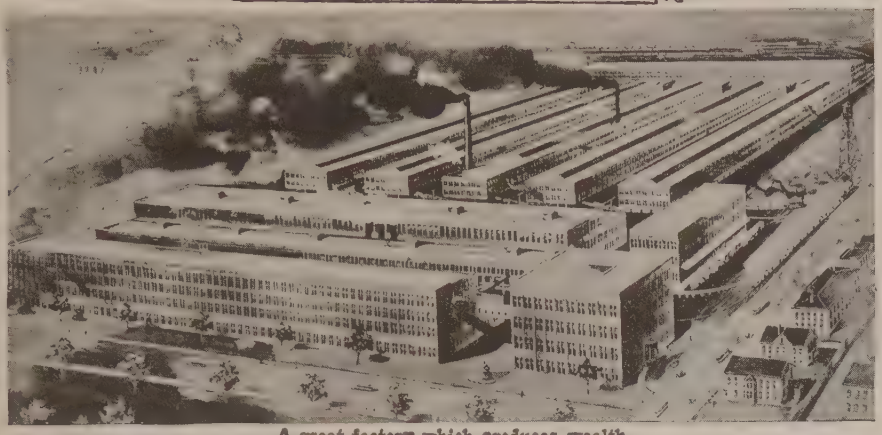
A neuf heures nous sommes descendus pour le souper. J'avais faim.
At nine hours we are descended for the supper. I had hunger.
At nine o'clock we went down to supper. I was hungry.

Les fraises étaient très bonnes, mais j'aime mieux les glaces.
The strawberries were very good, but I like better the ices.
The strawberries were very good, but I like ices better.

Nous avons dansé le Sir Roger de Coverley. Puis le bal était fini.
We have danced the Sir Roger de Coverley. Then the ball was finished.
We danced the Sir Roger de Coverley. Then the ball was over.

Nous avons dit: "Bonsoir," et nous sommes rentrés en voiture à la maison.
We have said: "Good evening," and we are returned in carriage to the house.
We said: "Good night," and drove home.

THE NEXT FRENCH STORY IS ON PAGE 6312.



A great factory which produces wealth.

THE DISTRIBUTION OF WEALTH

CONTINUED FROM 5936

WHEN we looked at the production of wealth we saw that three things went to its making—Labor, Land and Capital. Now we come to think how the wealth which is produced is shared up between those who labor, those who own land, and those who own capital.

In some cases a man labors on his own land and uses only his own capital. There are many small farmers in the world who are in this position. Such a man gets his living from tilling land for himself, and his capital consists of his buildings, his tools, machines, seeds, and his animals. In such a case the worker is at the same time the owner of the land, a worker on it, and a capitalist. As worker he not only labors, but supplies all the managing ability which is put into the work. Thus, as combined Worker, Landlord and Capitalist he takes for himself the whole product.

There are other trades in which a single person may be at once worker, landlord and capitalist. For example, a carpenter sometimes works for himself in a small workshop and uses his own tools and materials. He, too, enjoys the whole produce of his own work.

In modern work, however, it is common to find that those who work do own neither the land they work on nor the capital by which their work is made useful. Thus, a factory may be built on land owned by a landlord, to whom rent is paid for the use of the land. The factory building, and the machines in it, may be owned by people to whom a part of the wealth produced by the factory is paid for the use of their capital. The persons actually working in the factory, from the manager to the office boy, may own neither the land nor any part of the factory, but draw pay for the work they do. In such a case there is a clear division between the landlord, the capital and the workers.

Usually in modern business a factory and the land on which it is built are owned by a company of people who have put together, or subscribed, the money needed to buy them; and the workers own little or none of the capital.

We give different names to the shares of the produce which are taken by the workers, the landlords and the capitalists.

The share of the worker is called Salary or Wages; the share of the landlord is called Rent; the share of the capitalist is called Interest or Profit.

Let us deal first with the reward of labor. We saw, in dealing with the production of wealth, what a complicated thing labor is, including not merely hard work, which may or may not have a useful result, but the making of hard work really fruitful by guiding it with intelligence, informing it with invention, and multiplying it by organization. We cannot be reminded too often that it is necessary, not only to work, but to work in the best way, and that, while much work badly used may produce little wealth, a little work well used may produce much wealth.

In a manufacturing business, such as the making of textiles, or iron and steel, or engines, or ships, or chemicals, the workers may be divided into five classes.

1. *Organizers, or Captains of Industry.* These are the directors of the whole concern, who are responsible for the general management of its business in all its branches, and on whose enterprise and judgment depends its success or failure. They are paid sometimes by salary alone, but often by salary and a further payment which varies with the success of the business. Usually, too, they own shares in the business, and have therefore a further interest in making it profitable.

2. *Managers, Clerks and Salesmen.* The business side of the undertaking demands the employment of various orders of departmental managers, clerks to deal with books, orders, receipts and payments, and men usually called commercial travelers, or salesmen, who are sent out to get orders. All these are paid salaries, and often the managers and salesmen are paid additional sums, called bonuses or commissions, to encourage them to get more orders.

3. *Inventors, Scientists and Artists.* These may work either inside or outside the business. A firm may use a patented invention and pay a certain sum to the inventor for each use of his invention, or it may buy the invention outright for a lump sum. So many inventions are no longer patented, because under our law a patent is granted for only a short term of years, that many firms work actually without paying anything to inventors at all. Some businesses employ a special staff of scientists to improve their productions. An engineering firm, for example, has constantly to be working in this way. When a firm makes printed cloths, or furniture, or earthenware, or other artistic things, it has to employ artists and designers to make its work beautiful.

4. *Skilled Workmen.* The workman who has learned how to use tools, or how to carry out the technical work of his craft, is called a skilled workman. Examples of this are bricklayers, carpenters, masons, plasterers, turners, fitters and plumbers. Such men are indispensable in most manufacturing operations. They are usually paid weekly wages. In some trades payment is by time—so much an hour, or day, or week. In other cases payment is by results, that is to say, so much a job. Persons so paid are called piece-workers.

5. *Unskilled Workmen.* In addition to skilled workers many businesses employ people to do simple tasks which call for no special training or knowledge. These are the unskilled workmen, and their wages are considerably less than those paid to craftsmen. Thus, if we take the familiar case of housebuilding, a bricklayer is paid at one rate, whereas the unskilled worker (who carries the bricks and mortar for the bricklayer to use) receives much less. The use of machinery has greatly increased the call for unskilled workers, because so many operations have become simple in their character.

We see, then, how complicated a thing is the reward of Labor, because work takes so many different forms. The other factors of wealth production, Land and Capital, also call for their payments, and we must now consider these.

Rent, the share of the landlord, is paid for the use of land or some other gift of Nature. In an old country, or in a great city, where every foot of land has been worked over, and little is left remaining in its natural condition, it is very difficult to distinguish gifts of Nature from the work of men. In common speech, therefore, we come to use the word Rent as applying to any payment made for the use of land and what is built on it. The true "rent," however, is not this total payment, but only that part of the payment which is made for the natural piece of land.

This distinction may seem unimportant but it is not really so. Let us consider the rent of a shop on an important street in a great city and the rent of a building of similar size in some small town. Why is it that the building in the city has a very heavy rent, while the building in

the town has a very small rent? It is not through the building, because even if the building in the town cost more than the building in the city, the city rent would still be much higher than the other. The real reason is that the city street is in such a *fine position*, and has so many more people passing through it than the street in the little country town, that a shopkeeper can sell more things in the same time in the city street than in the country street, and therefore it is worth while for the shopkeeper to pay a higher rent. *Thus the real rent (the economic rent, as it is sometimes called) is the price of the natural advantage of one site over another.*

How rents are affected by natural and other conditions

So it is in farming. If a farm has poor soil, or is badly situated, it yields less than a farm with a rich soil or a good situation. So we see how some landlords may be able to obtain a high rent, while others can get only a small one. In the case of farm land, the rent depends on fertility and nearness to markets. In the case of building land, it depends on the amount of business which can be done. Sometimes, again, land may be specially valuable because there are minerals under the surface. If coal is discovered at a certain spot, coal-mines and factories will be established. Houses and shops will arise, and so the land near the coal will become valuable and command a high rent.

Sometimes a railway will raise rents by bringing people together and creating a demand for houses in the neighborhood. In the days when railways were first made, some landlords strongly objected to them, and prevented them from passing near their properties. When they did so, they robbed themselves of rent without knowing it.

We come now to Interest and Profit, taken by the capitalist.

People who save money and lend it for use in business receive a return which varies with the risk they take. When a person lends money to the Government of a great nation, the risk he runs is comparatively small, and the payment he gets for the use of his money is small. Money lent on good security to an old-established business runs a greater risk, though it is still a comparatively small one. So it is with money lent on the security, or mortgage, as it is called, of good buildings, where the lender's security is in the fact that if he is not paid he may seize the buildings.

The difference between profit on capital and interest on money lent

The payment for the use of money lent is called Interest, but when somebody lends money (or subscribes capital, as we call it) to set up a business, and there is no guarantee that the money will be repaid, a great risk has often to be taken, and the payment for such risk is called Profit.

So we see that the reward of capital consists of two distinct parts, the first being Interest—the payment for the use of money when it is almost certain the money will be safely repaid; and the second Profit—the payment for the risk taken in the matter.

If everyone who saved money wanted to keep it quite safe, there would be very little enterprise. It is just because some people are willing to take risks, on the chance of being paid for their risks, that capital comes to be invested in business enterprises. Enormous sums are lost by those who take such risks. In our own country alone hundreds of millions of dollars have been lost in various enterprises.

The laws of supply and demand and the distribution of wealth

The distribution of wealth between Labor's share (wages and salaries), the Landlord's share (rent), and the Capitalist's share (interest and profit) is a very difficult matter to decide. In a way we may say that they are influenced by the laws of demand and supply, though this does not tell quite the whole story. Notice that here we are speaking of distribution, and not of production. Whether there is much production or not depends on how the labor, land and capital are used. Demand and supply affect rent as they affect prices. If a great many people have to live in one place they all demand houses, and therefore there is a big call for land at one place. So the demand raises the price of the land, or the rent paid for the use of it. Is it possible, in such a case, to increase the supply of land to the people who want houses? Curiously enough, it may be said to be possible, because by making a building, a railway or car line, or by setting busses to running we make it possible for people to live farther away and get back quickly to the

spot where business calls them together. So the homes of the people could be spread and, in effect, a larger supply of land could be made available for them, in which case the rent at the busy spot would fall.

With capital, too, demand and supply affect payments. For instance, if a new and successful trade springs up, big profits may at first be made in it. What happens, then, is that big profits induce more capitalists to put money into the new business, and so the supply of capital in that trade grows. The result of this bigger supply of capital is to bring down the profits. That is what has happened in the automobile industry, and also in moving pictures in which at first enormous profits were made. This led to much capital being brought into the businesses, and, as the result, profits are less, unless the business is very well managed.

When we come to wages, we find that demand and supply affect them also as they affect the prices of goods.

THE DEMANDS FOR HIGH WAGES THAT ARE SOMETIMES BAD FOR TRADE

We saw in studying prices how the demand for goods really means the demand at a certain price. The demand for workers in practice means demand at a certain wage. The employer cannot pay more than a certain wage at any particular time unless he can get greater production from the same number of workers. If more is asked, he cannot pay it, and he has to go out of business. It is useless for the employer to go on making goods which are too expensive for people to buy; therefore, if labor demands a wage higher than can be borne by the goods out of the price at which they can be sold, the wage cannot be paid and the business must stop.

The supply of labor in a trade also governs the price of labor. For example, if the number of carpenters were suddenly doubled, it would be very bad for the carpenters, because the amount of carpenter's work would not suddenly be doubled, and therefore the price of carpenter's work (wages) would fall. In practice, this does not happen, because new-comers enter trades a few at a time, and the common experience of life prevents young people from entering trades which are not growing.

While, as we have seen, an employer cannot pay a worker more than the price of his goods allows, he may pay less if the worker is not able to protect himself, and often he does so. This arises from the fact we have already noticed, that so many people do not themselves own capital, and can therefore earn their living only by offering to work for people who do own capital. This gives the capitalist an advantage over the worker, an advantage which can be modified only by good feeling and justice, or by the workers' uniting to resist injustice.

WHY GOOD TRADE UNIONS ARE A BENEFIT TO ALL

It was this weakness on the part of the worker in bargaining with the capitalist that led to the formation of trade unions. A Trade Union is a society of workers banded together to secure for themselves the highest wage which the profits of their trade allow.

Let us clearly understand this. We saw that there is a certain wage beyond which the employer cannot go if he is to make a living for himself. He is entitled to that living, for his work is valuable to society and to the people he employs. He is a captain of industry, and, like the captain of an athletic team, he is indispensable. He is not entitled, however, to make undue profit by underpaying his work-people. There is always the danger of his being a bad judge of his own case. The trade union, if it does its duty, will see that its members are not underpaid, and yet it will not be so foolish as to demand a wage higher than the industry can pay. However, just as the employer is very often a bad judge of the justice of his own case, so the unions are not always wise or fair in their demands upon the employer.

GOOD-WILL AND UNDERSTANDING WITHOUT WHICH WE CANNOT PROSPER

Sometimes, unfortunately, grave quarrels take place, and the capitalists and the unions cannot agree. Then we hear of labor troubles, which may take the form of a strike (which means that the workers refuse to go on with their work) or of a lockout (which means that the employers close their works and refuse to pay the wage demanded). Such misfortunes can be prevented only by good-will and thorough understanding on both sides. That is why it is so important for everyone to understand the things of which we have been speaking.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 6359.

THE FIRST APPLE DUMPLING

CONTINUED FROM 6036

THE princess was looking up at the apple tree when —plop! down fell an apple at her feet!

It was not a common, ordinary apple, or it would not have been growing there, but a golden pippin.

"Oh dear!" said the princess, picking it up. "I hope you haven't hurt yourself."

"They dared me to do it," said the apple—"the other apples, you know. They said I should be afraid to let go my stalk and jump. And I just held my breath and counted one, two, three and jumped. And now that I *have* done it, I'm sorry, for someone will want to eat me, and I am not nearly ripe enough!"

"I will hide you," said the princess.

And she ran into the palace to look for a hiding-place. But whenever she opened a box or a cupboard the apple cried: "That won't do. Someone will be sure to find me there!"

The princess went all over the palace, upstairs and down, looking for a safe hiding-place for the apple; and at last, feeling quite exhausted, she came to the kitchen. The chief cook was rolling out paste with a golden rolling-pin to make a roly-poly pudding with golden syrup in it for the princess's dinner.

The princess was still looking about for a hiding-place when one of the silver saucepans boiled over, and the chief cook left off rolling the paste to attend to it. The instant his back was turned, the princess took some paste and wrapped the apple up in it.

"No one will think of looking for you there," she whispered.

Then she saw that the door of an oven, out of which a cook had just taken a tray of tarts, was open, and she popped the apple in, to hide it twice over.

"Dear me, what is this?" asked the king at dinner, as he caught sight of a round brown thing on a dish.

"I don't know, your Majesty," was the answer. "The chief cook said he found it in the oven, but he thought your Majesty would find it very good to eat."

"Give me a knife, and I'll see."

"My dear," said the queen, "pray be careful. Suppose it should go off suddenly and blow us up!"

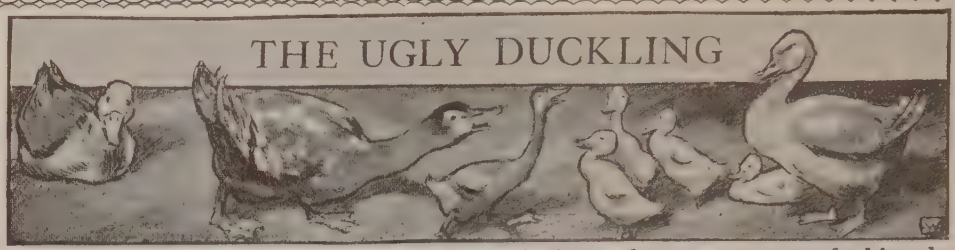
"Pooh!" said the king boldly. "Who's afraid?" And he cut it in two with a single stroke of the knife.

"Why," he said, "it looks like an apple. And yet it can't be. For how could an apple get inside——"

"Papa," put in the princess, "I think it must be the apple I hid. It wasn't ripe and was afraid someone would eat it. But perhaps it won't mind so much now it is cooked."

The next day the king asked the princess to show the cook how to hide some more apples. And that is how apple dumplings were invented.

THE UGLY DUCKLING



AN old Mother Duck, who was very proud of her handsome family, was much disappointed when a little one was hatched who was so ugly that everybody called him the Ugly Duckling.

"I never imagined," she said to a friend who came to visit her, "that I should ever have such an ugly child. Just look at the others, how pretty they are and how gracefully they move!"

Soon the ducklings grew old enough to have their first swimming lesson.

"Quack, quack!" cried the Mother Duck, and out they all came, as fine a brood of ducklings as any mother could wish to see. And behind them came the Ugly Duckling, alone and forlorn.

"Do you not see your young brother?" said the Mother Duck.

"He can't be our brother," they replied scornfully. "He is so ugly that we can't bear to look at him."

But when they found that he took to the water as a brave young duck should, and beat them all at their games and races, they were jealous of him, and angry that one so inferior in appearance should in any way excel.

One day the Mother Duck took her children to visit some friends in a neighboring farmyard. They had not been there long before the Ugly Duckling found everybody staring at him, and one old duck even flew at him and bit him on the neck.

"You are not like the rest of us," he said. "You are so big and ugly. Why do you come here?"

"Let him alone," said the Mother Duck. "He is not pretty like my other children, but he is good-natured, and he swims better than any of them."

But when the mother's back was turned, the Ugly Duckling had a bad time of it. They all made fun of him, and gave him sharp pecks.

"They all hate me because I am ugly," sighed the Ugly Duckling, "and it is through no fault of mine. I am evidently not wanted. I shall go away."

And so when no one was looking he stole away. On and on he went until he came to a great moor, where he saw a number of wild ducks who came to have a look at the stranger.

"How do you do?" said the Ugly Duckling politely.

But they stared at him for some time without answering, and then one said: "How ugly you are!" And then they all began to laugh. But just at that moment there came a sound which terrified the poor duckling.

"Pop, pop!" went a gun, and down dropped the wild ducks one by one.

The smoke from the guns blew across the water and choked him, and as it faded away in the air the duckling was terrified to see a huge dog dash into the water and come swimming toward him. He was too frightened to move, but to his surprise the animal, with a sniff, passed him and left him trembling from head to foot with fright.

"I am so ugly that even a dog cannot bear to look at me," he thought, and he shivered and dared not move till the sun had gone down, lest other strange dangers should come upon him.

When morning dawned he caught sight of a little cottage that lay close by. Perhaps it might offer shelter for the poor lost duckling, who felt so helpless in a strange world.

He went up to the door and peeped in. An old woman stood by the hearth, and near by crouched a cat and a hen.

"Perhaps they will not notice how ugly I am, and will let me stay," thought the duckling. And he crept in and waited just inside the doorway.

The cat saw him first, and she began to purr loudly, and the old woman looked round.

The Ugly Duckling held his breath for fear that she should turn him out. But a smile spread over her face.

"How fortunate I am," she exclaimed; "now I shall have some duck's eggs!"

But the duckling did not present her with any eggs, and after a time the cat and the hen began to quarrel with him.

"I don't know of what use you are in the world," said the hen disdainfully. "You cannot lay eggs as I can; you cannot even purr like the cat, and nobody could call you handsome."

"I think I had better go, before they turn me away," sighed the poor duckling, "but where to go I cannot think."

And so he left the cottage and returned to the water, feeling even more lonely and helpless than before he had come.

That evening at sunset there came out of the bushes a flock of birds so beautiful and so white that the Ugly Duckling gazed at them in astonishment. They were swans. It was the first time that he had ever seen a swan, and he thought that he had never seen anything so beautiful. They uttered strange cries as they passed, and for some minutes the duckling watched them, admiring their beauty with sad, half-envious feeling.

"How glorious to be so beautiful!" he thought.

By and by came the winter, with the cold and the ice, and the poor duckling, cold and often hungry, longed for the home that he had left, for, bad as things had seemed there, they were far worse now.

The old woman looked round and a smile spread over her face. "How fortunate I am!" she said.

Sometimes the air was so cold that he was obliged to keep swimming about to prevent the water from freezing.

Once he was so tired and stiff with the cold that he could scarcely move, and then the pond froze around him, and he would have died if a farmer, who was passing, had not broken the ice with his stick and rescued him.

The farmer took him home, and warmed and fed him, and the Ugly Duckling thought at last he was among friends. But in the afternoon, when the children came home from school, they ran toward him with cries of joy, and the duckling, thinking they meant to do him harm, flew up, and in his terror fluttered into the meal-tub, scattering the meal far and wide. This made the farmer's wife so angry that she picked up a stick to beat him. But luckily he saw her in time to escape.

Once again the duckling was homeless, and all through the winter he suffered from cold and hunger, until at last came the beautiful spring, with soft, gentle breezes and warm sunshine.

"This is good!" said the duckling. "It makes me feel quite strong."

And on he went until he came to a pond. The pond was as smooth and as clear as a mirror, and in passing the Ugly Duckling looked down at his reflection. He was startled. Surely something was wrong! He looked again, and then he gazed all around, but no creature was in sight. What could it mean? Instead of a big, ugly duckling he saw a tall, graceful swan, as beautiful as the birds he had once seen. What had happened? Could it be that he, the Ugly Duckling, had changed into a beautiful swan?

He looked up, and there he saw gliding toward him a number of these beautiful creatures. They greeted him politely, and called him brother. "Come with us," they cried. "You are such a fine fellow, we would have you join us."

The Ugly Duckling hesitated, fearing the invitation was a new form of mockery. Suddenly he remembered his reflection.

And then, lifting up his head, and quivering with excitement and joy, the Ugly Duckling, who no longer deserved his name, proudly followed his fellow-swans, with whom he lived happily ever after.

A TALE OF CHRISTMAS EVE

TOLD BY A CHRISTMAS STOCKING

IT was long past midnight, and the Stocking was angry.

"To be taken out of a nice comfortable drawer on a winter night," it said querulously, "and without being hung on a nice horse in front of the kitchen fire to be strung up to a bedpost like a common thing, upon my word, it is too bad!"

A little girl lay fast asleep in the bed. The curtains were drawn across the window. In a saucer on the bureau burned a night-light. The clothes of the sleeper lay neatly folded on a chair beside the wall; the stockings which she had worn during the day hung dreaming over the back of this chair, and underneath were her little buckled shoes, both of them snoring.

"I miss my mate," said the Stocking, glancing at the folded pair of sleeping stockings over the back of the chair. "It's downright monstrous to take one stocking from a drawer and leave its mate behind! If I worked for a one-legged child or a mermaid it would be a different matter. Oh, my poor heel and toe, how cold they are!"

Just as it finished speaking there was a noise in the chimney, and looking in the direction of the fireplace, the Stocking was amazed to see a very old, white-bearded gentleman in a red cloak, with a hood on his head, descending to the hearth. The night-light burned suddenly brighter; the room became warm and cheerful. The Stocking, which was too wonder-struck to speak, thought that it had never seen such a quaint old man in all its life.

"If this is a burglar," it thought, "may I have a potato in my heel for the rest of my life!"

The old gentleman, who was no other person than Father Christmas, advanced to the bed and let a big bag which he carried on his shoulder slide to the ground.

"Ha," he said, in a very cheerful voice, "how she has grown, to be sure! Why, when I was here twelve months ago I could have put her into one of my waistcoat pockets." He looked about the room. "Nice and tidy," he said approvingly. "Clothes neatly folded; frock hung up; books nicely put away; no broken toys about; the doll I gave her last year safely tucked up in its cradle, the Teddy Bear hasn't lost an eye, and gray rabbit is still full of sawdust. Come, Marsie, you're growing quite a good little girl." He walked to the foot of the bed. "Ha," he said, laughing, "this is the only night in the year when the foot of the bed has a stocking!" He put his hand on the Stocking, and said: "Well, my grumbling friend, how do you find yourself to-night?"

"Rather lonely," answered the Stocking. "I miss my mate terribly; and it's cold. They took me out of my nice warm drawer and hung me up here alone in the dark without a glimpse of the fire."

"Oh, I'll warm you quick enough!" said Father Christmas, and diving into his sack and pulling out all manner of toys and boxes of sweets, he began to cram the Stocking with Christmas presents.

"Hold hard!" cried the Stocking. "You'll split me if you aren't careful! What next, I wonder! I'm a stocking. What do you take me for—a Danish bazaar, the toy department of a big store, or what?"

Father Christmas laughed. "You're new to this game, then?" he asked.

"I was only born this winter," said the Stocking. "I grew on a very nice sheep in Russia until the beginning of the spring. Then I was cut off, sent to a mill, and woven into the handsome stocking that you see I am now. I've been worn only four times, and I've scarcely shrunk an eighth of an inch in the wash. I thought I was in for a very easy life. My young lady doesn't wear me hard, and Neto, her auntie, is a good darner. I go for walks in the garden, rides with the pony, and drives in the motor car. If it's very cold they wrap me in leggings, and put a nice fur rug over them. Hi! What are you up to now? I can't bear any more! You're stretching me out of shape! You'll burst me!"

In the morning, very early, Marsie woke up and emptied the Stocking of all its toys and sweets, and let it fall on the floor. Aunt Neto came later, kissed the little maid, and picked up the Stocking.

"Your work is done," said she, and placed the Stocking back in the drawer.

"Well," said its mate, "and where have you been all night? Staying out by yourself till the morning like this! You ought to be ashamed of yourself, you know you ought!"

"My dear," said the Stocking, "I've never worked so hard before or been so happy. But permit me to wish you a merry Christmas and a happy New Year," and snuggling down in his drawer, he went to sleep.

CATCHING A THIEF

THE ADVENTURE OF SCREWWORM, SCRAMBLEPIPE AND BURROWJACK

"WE must put a stop to this thieving," said Scramblepipe. Another gnome named Burrowjack nodded his head and thoughtfully combed his beard with his finger-nails.

"It's my belief," he said slowly, "that the villain lives above ground."

"Ah," cried Screwworm, "I'm positively certain of that!"

Scramblepipe and Burrowjack looked at Screwworm.

"Yes," said Screwworm, who was a particularly small and a particularly venerable gnome, "I'm as certain of that as I am of fireworks, ironmongery, boiled potatoes, *tableaux vivants* and apple-blossom. And I'll tell you why: Three nights in succession I've dreamed of white coal!"

"You don't say so!" exclaimed the other two.

"Three nights running," said Screwworm emphatically.

"What, running fast?" demanded Burrowjack with much concern.

"Those nights traveled at sixty minutes an hour," replied Screwworm solemnly.

The other two gnomes whistled with amazement.

For some weeks past the wife of Scramblepipe had missed several magnificent diamonds. Although a watch had been set, the diamonds still went. The entire underworld of gnomes had been alarmed by these robberies. It was agreed that if the thief were not very soon laid by the heels, every gnome would have to turn out his pockets. This was a dreadful fear; for, as everybody knows, the pockets of a gnome contain enough red pepper to sneeze the crust off the earth.

"We'll keep a watch above ground," said Scramblepipe.

"A stop watch," said Burrowjack, with great resolution.

That night they stole noiselessly out of their black underworld. They crept on all fours, holding their breath. They were as careful as mice and as silent as cats. Scramblepipe went first, then Burrowjack and then Screwworm. They crept from the blackness of the earth into the white moonlight of the forest. Not

a leaf was stirring; not a sound rustled the stillness.

Suddenly old Screwworm screeched in a loud voice: "There he is! That's the villain! See how guilty he looks. Throttle him, stab him, cut him into mincemeat, tickle his ribs and fry his toes!"

The other two looked where he pointed, and saw Tom Squirrel burying something in the ground.

"Thief! Thief!" they cried in loud voices. They began to dance with fury.

Tom Squirrel looked up, brushed his whiskers with his paws, and then ran up a tree.

"Fetch a ladder!" cried Screwworm.

"And a policeman's whistle!" shouted Burrowjack.

"And a club to knock his head off!" yelled Scramblepipe.

The three little gnomes ran frantically about in every direction, screaming all the time: "Now we've got him! Now we'll catch him! Oh my, isn't it Turkish delight to catch a thief?"

They got a ladder and sticks and a policeman's whistle, and ran to the tree. Tom Squirrel sprang lightly to a branch and sat down. Burrowjack put the ladder to the tree. Scramblepipe jumped about, waving his stick. Old Screwworm blew the policeman's whistle till he was red in the face. Tom Squirrel blinked his eyes and hummed softly: "Gnome, Sweet Gnome."

Scramblepipe went up the ladder. Tom Squirrel cocked his tail and hopped to another tree. Down came Scramblepipe, chuckling with delight, and the ladder was put to the other tree.

"Your turn now," said Scramblepipe to Burrowjack.

"Right you are, old gingerbread!" said Burrowjack, and ran up the ladder with his stick held tightly between his teeth.

Tom Squirrel hopped to another tree, and down came Burrowjack, screaming with laughter.

"Your turn now, Screwworm," said Burrowjack. And old Screwworm, putting his policeman's whistle behind his ear, mounted the ladder one step at a time.

"Steady does it," said the old fellow.

"Mind your feet don't get cold," said Scramblepipe.

"Hullo! Hullo! Hullo!" cried Screwworm suddenly. "What have we here? Blushing birds! Birds a-blushing, and under their own noses too? They're the thieves! They're the thieves! Now we've got them!"

He had seen a nest of red-breasted birds on the next tree. The other two swarmed up to this nest and pulled it down. They tore it to pieces, and searched among the twigs and moss and horsehair, but could find no diamonds, the little birds protesting vigorously the while.

"It's a mare's nest," cried Burrowjack angrily, looking at Screwworm with a threatening eye.

"Don't hit me," pleaded Screwworm. "I can't bear being hit in the moonlight, not even on the top of the head."

One of the little birds moved at Scramblepipe's feet. He stooped down to pick it up, and saw in a hollow of the old tree an immense toad.

"Hist!" he said. "Let's have a joke. Here's old Tom Tiddler fast asleep!"

They got sticks and pieces of wood, and laughing fit to split their sides, boarded up the old toad in his hole in the tree.

"He'll never get out," they chuckled. "What a lark! He's there till the crack of doom! Oh, isn't that beatific?"

"And now for Tom Squirrel," said Burrowjack, growing serious.

But when they looked up, Tom Squirrel was nowhere to be seen. Scramblepipe stroked his chin; Burrowjack bit his nails.

"Never mind," said Screwworm cheerfully, "we've had a jolly night, haven't we?"

They were just about to start off when a faint sound of laughing checked them.

"What's that?" they cried. They listened, with fingers to their lips.

"It must be Tom Squirrel," whispered Burrowjack.

"He's hiding and laughing at us," said Scramblepipe.

"Oh, he's the thief sure enough!" said old Screwworm.

"Wait till we catch him!" said Burrowjack in a threatening tone.

"Ah, he won't laugh then!" said Scramblepipe, and they went off together, saying, in loud voices: "You'll laugh on the other side of your face when we catch you, Tom Squirrel."

. . . . . .

The world went well with Tom Squirrel

TOM SQUIRREL LOOKED UP, BRUSHED HIS WHISKERS, AND RAN UP A TREE

for many a day, and the three gnomes were all forgotten when, a hundred years afterward, the old tree was cut down, and the woodman was surprised to see a very ancient toad hop out of a hole, laughing so uproariously that his skin kept cracking in all directions.

"What are you laughing at?" asked the woodman.

"I've been laughing for a hundred years," said the toad, as he hopped off to the pool for a drink of water.

Looking into the hole, the woodman was amazed to see—what do you think? A heap of magnificent diamonds in the place where the toad had been squatting!

For a hundred long years old Tom Tiddler had sat on the stolen gems and had laughed at the joke he had played on Scramblepipe, Screwworm and Burrowjack. The gnomes had laughed as they boarded up the toad in the hollow tree. But they never suspected the truth. No wonder Tom Tiddler laughed!

SANTA CLAUS

THE TRUE STORY OF FATHER CHRISTMAS

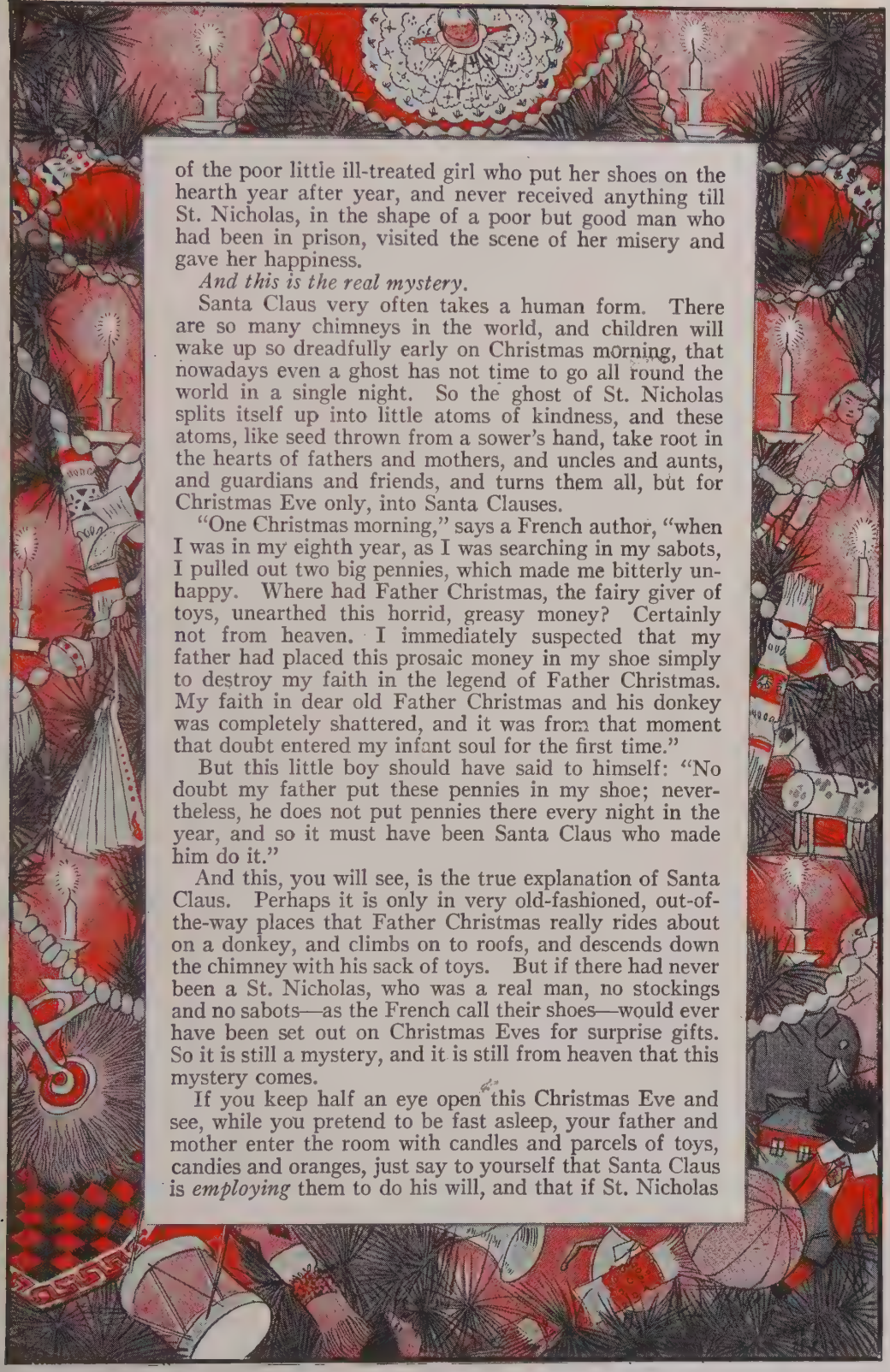
CHRISTMAS EVE is the greatest night in the year. It is a night of mystery. When everybody is in bed, except the policeman, down the chimney comes an old gentleman in a red cloak, bordered with white wool, carrying over his back an immense sack stuffed with toys and bonbons, which he empties into the stockings of good little boys and girls asleep in their cots.

The policeman does not see the old housebreaker: the black soot does not smirch his beautiful red-and-white cloak; more wonderful still, the smallest chimney on the humblest roof in all the world is wide enough for his descent, sack and all. The fact is, Santa Claus, Saint Nicholas, Father Christmas, *Bonhomme Noël, Knecht Clobes,* or whatever else children may call the old gentleman with the sack—the fact is, *he is a ghost.*

He is the ghost of that good St. Nicholas who went about doing generous acts in secret; who slipped money, silver and gold, through the keyholes or under the doors of poor people, and made homes happy without letting anyone know how it happened. Nicholas was a kind man, and now he is a kind ghost. All over the world—in Europe, America, Asia, Africa and Australasia—the ghost of this good old man on Christmas Eve passes down millions of chimneys, and fills billions of stockings with trillions of toys and quadrillions of candies. Yes, really and truly, it is the spirit of St. Nicholas who comes across the snow on Christmas Eve.

In France *Bonhomme Noël,* as they call Santa Claus, is accompanied by another ghost—a thin, weasel-faced old gentleman, with long gray beard, threatening dark eyes and a frowning forehead. This is *Le Père Fouettard.* In French our word *whip* is *fouet;* so you see that *Le Père Fouettard* means, in English, "Father Whipper." This Father Whipper, who accompanies Father Christmas in France, carries on his shoulder a wickerwork basket filled with tiny birch rods, and he leaves one of these whips for every child who has been naughty, or cross or greedy during the year. Father Christmas, of course, comes only to children who are trying to be good.

There is still another difference in France. Children do not hang up their stockings on Christmas Eve; instead, they put their little sabots, which are wooden shoes, in front of the hearth, close to the chimney by which Father Christmas descends. If you have read Victor Hugo's wonderful book *Les Misérables,* you will remember the story



of the poor little ill-treated girl who put her shoes on the hearth year after year, and never received anything till St. Nicholas, in the shape of a poor but good man who had been in prison, visited the scene of her misery and gave her happiness.

And this is the real mystery.

Santa Claus very often takes a human form. There are so many chimneys in the world, and children will wake up so dreadfully early on Christmas morning, that nowadays even a ghost has not time to go all round the world in a single night. So the ghost of St. Nicholas splits itself up into little atoms of kindness, and these atoms, like seed thrown from a sower's hand, take root in the hearts of fathers and mothers, and uncles and aunts, and guardians and friends, and turns them all, but for Christmas Eve only, into Santa Clauses.

"One Christmas morning," says a French author, "when I was in my eighth year, as I was searching in my sabots, I pulled out two big pennies, which made me bitterly unhappy. Where had Father Christmas, the fairy giver of toys, unearthed this horrid, greasy money? Certainly not from heaven. I immediately suspected that my father had placed this prosaic money in my shoe simply to destroy my faith in the legend of Father Christmas. My faith in dear old Father Christmas and his donkey was completely shattered, and it was from that moment that doubt entered my infant soul for the first time."

But this little boy should have said to himself: "No doubt my father put these pennies in my shoe; nevertheless, he does not put pennies there every night in the year, and so it must have been Santa Claus who made him do it."

And this, you will see, is the true explanation of Santa Claus. Perhaps it is only in very old-fashioned, out-of-the-way places that Father Christmas really rides about on a donkey, and climbs on to roofs, and descends down the chimney with his sack of toys. But if there had never been a St. Nicholas, who was a real man, no stockings and no sabots—as the French call their shoes—would ever have been set out on Christmas Eves for surprise gifts. So it is still a mystery, and it is still from heaven that this mystery comes.

If you keep half an eye open this Christmas Eve and see, while you pretend to be fast asleep, your father and mother enter the room with candles and parcels of toys, candies and oranges, just say to yourself that Santa Claus is *employing* them to do his will, and that if St. Nicholas

had not lived and done kindly things, you would never have had that box of soldiers, that automobile, that farmyard, that grocer's shop, that doll, that box of chocolates, that pair of reins, that book of fairy-tales, those crackers and that box of candied fruit on Christmas morning.

Saint Nicholas. He died and was buried like any ordinary man. But one man, whom men called Nicholas, has from his grave, for hundreds of years, inspired the whole civilized world to be kind and generous on Christmas Eve. He was not a mighty warrior, but he has done more

AN OLD GENTLEMAN IN A RED CLOAK CARRIED ON HIS BACK A SACK STUFFED WITH TOYS

Is it not much more mysterious than Santa Claus himself? Do not think that you are very sharp and clever to have found out how the toys and candies come to you on Christmas Eve. It is one of the great mysteries of life.

For once upon a time there lived a rich young man who tried, because he so much admired the kind and gentle character of Christ, to make his money give other people happiness. He went about placing coins and gifts in the homes of poor people. He did good in secret. The name of this young man was Nicholas. When he died, people called him

for the happiness, kindness and good-humor of the world than Cæsar or Napoleon. Is that not a far greater mystery than Santa Claus and his donkey or his reindeer?

Learn from this story that a beautiful character is more powerful than any fairy, and understand that your presents at Christmas are given to you in secret only that you, when you grow up, may follow the example of giving without telling.

Santa Claus, even if he come in your father's or your mother's person, is still the loving spirit of the good Nicholas.

THE NEXT STORIES ARE ON PAGE 6199.

GOD REST YOU MERRY, GENTLEMEN

Carol-singing at Christmas-time is, of course, a very ancient custom. Long ago the carols were purely religious hymns, expressing joy for the birth of the Saviour Christ, but in the course of time all sorts of merry tunes specially composed for singing at Christmas-time came to be known as carols. This is one of the oldest carols, and it tells the story of Christ in simple verses. It has been sung in England for centuries, and there are many different versions of the carol, but that given here is perhaps the best.

CONTINUED FROM 0028

GOD rest you merry, gentlemen,
Let nothing you dismay;
For Jesus Christ, our Saviour,
Was born upon this day,
To save us all from Satan's power,
When we were gone astray.

O tidings of comfort and joy,
For Jesus Christ, our Saviour, was
Born on Christmas Day.

In Bethlehem, in Jewry,
This blessèd Babe was born,
And laid within a manger
Upon this blessèd morn;
The which His mother Mary
Nothing did take in scorn.
O tidings, etc.

From God, our Heavenly Father,
A blessèd Angel came,
And unto certain shepherds
Brought tidings of the same;
How that in Bethlehem was born
The Son of God by name.
O tidings, etc.

"Fear not," then said the Angel,
"Let nothing you affright;
This day is born a Saviour,
Of virtue, power and might,
So frequently to vanquish all
The friends of Satan quite."
O tidings, etc.

The shepherds, at those tidings,
Rejoicèd much in mind,
And left their flocks a-feeding
In tempest, storm and wind;
And went to Bethlehem straightway
The Son of God to find.
O tidings, etc.

But when to Bethlehem they came,
Whereat this Infant lay,
They found Him in a manger,
Where oxen feed on hay;
His mother Mary kneeling,
Unto the Lord did pray.
O tidings, etc.

Now to the Lord sing praises,
All you within this place,
And with true love and brotherhood
Each other now embrace;
This holy tide of Christmas
All others doth deface.

O tidings of comfort and joy,
For Jesus Christ, our Saviour, was
Born on Christmas Day.

OLD CHRISTMAS

The very spirit of the old-fashioned Christmas, which unhappily has mostly passed away, breathes again in these graphic verses from the pen of the great Sir Walter Scott. In the twenty-sixth line the word "underogating" means that the nobleman, "without losing his dignity" may at this season play with the villager.

HEAP on more wood!—the wind is chill,
But let it whistle as it will,
We'll keep our Christmas merry still.

Each age has deem'd the new-born year
The fittest time for festal cheer;
And well our Christian sires of old
Loved when the year its course had roll'd
And brought blithe Christmas back again
With all his hospitable train.
Domestic and religious rite
Gave honour to the holy night;
On Christmas Eve the bells were rung;
On Christmas Eve the mass was sung:
That only night in all the year
Saw the stoled priest the chalice rear.
The damsel donn'd her kirtle sheen,
The hall was dress'd with holly green;
Forth to the wood did merry-men go,
To gather in the mistletoe.
Then open'd wide the baron's hall
To vassal, tenant, serf, and all;
Power laid his rod of rule aside,
And Ceremony doff'd his pride.
The heir, with roses in his shoes,
That night might village partner choose;
The lord, underogating, share
The vulgar game of "post and pair."
All hail'd with uncontroll'd delight
And general voice, the happy night,
That to the cottage, as the crown,
Brought tidings of Salvation down.

The fire, with well-dried logs supplied,
Went roaring up the chimney wide;
The huge hall-table's oaken face,
Scrubb'd till it shone, the day to grace,
Bore then upon its massive board
No mark to part the squire and lord;
Then was brought in the lusty brawn,
By old blue-coated serving-man;
Then the grim boar's head frown'd on high,
Crested with bays and rosemary.
Well can the green-garb'd ranger tell
How, when, and where, the monster fell;
What dogs before his death he tore,
And all the baiting of the boar.
The wassail round, in good brown bowls,
Garnish'd with ribbons, blithely trowls.
There the huge sirloin reek'd; hard by
Plum-porridge stood, and Christmas pie;
Nor fail'd old Scotland to produce,
At such high tides, her savoury goose.
Then came the merry-makers in,
And carols roar'd with blithesome din;
If unmelodious was the song,
It was a hearty note, and strong.
Who lists may in their mumming see
Traces of ancient mystery;
White shirts supplied the masquerade,
And smutted cheeks the visors made;—
But, O! what maskers, richly dight,
Can boast of bosoms half so light!
England was merry England, when
Old Christmas brought his sports again.
'Twas Christmas broach'd the mightiest ale;
'Twas Christmas told the merriest tale;
A Christmas gambol oft could cheer
The poor man's heart through half the year.

CHRISTIANS, AWAKE!

This famous carol was written by John Byrom, who was born at Kersal in 1691, and died at Manchester in 1763. Most of his poetry is humorous, but this beautiful song he wrote in 1745 for his little daughter, Dorothy. He had promised to write her something for Christmas, and on Christmas morning she found the manuscript of Christians, Awake! among her presents. But the title he had given to the poem was, Christmas Day for Dolly.

CHRISTIANS, awake! Salute the happy morn,
Whereon the Saviour of mankind was born.
Rise to adore the mystery of love,
Which hosts of angels chanted from above;
With them the joyful tidings first begun
Of God Incarnate and the Virgin's Son.

Then to the watchful shepherds it was told,
Who heard the angelic herald's voice, "Behold,
I bring good tidings of a Saviour's birth
To you and all the nations upon earth:
This day hath God fulfill'd His promised word,
This day is born a Saviour, Christ the Lord."

He spake; and straightway the celestial choir
In hymns of joy, unknown before, conspire.
The praises of redeeming love they sang,
And Heaven's whole orb with Alleluias rang;
God's highest glory was their anthem still,
Peace upon earth, and unto men good will.

To Bethlehem straight the enlighten'd shepherds ran,
To see the wonder God had wrought for man;
And found, with Joseph and the Blessed Maid
Her Son, the Saviour, in a manger laid.
Then to their flocks, still praising God, return,
And their glad hearts with holy rapture burn.

O may we keep and ponder in our mind
God's wondrous love in saving lost mankind.
Trace we the Babe, who hath retrieved our loss,
From His poor manger, to His bitter Cross;
Tread in His steps, assisted by His grace,
Till man's first heavenly state again takes place.

Then may we hope, the angelic hosts among,
To sing, redeem'd, a glad triumphal song:
He that was born upon this joyful day,
Around us all His glory shall display;
Saved by His love, incessant we shall sing
Eternal praise to Heav'n's Almighty King.

CHRISTMAS MORNING

Edwin Waugh, who was born in 1817 and died in 1890, achieved considerable fame through his writings in the Lancashire dialect. In this English poem he expresses very sweetly the spirit of Christmas time.

COME, all ye weary wanderers,
Beneath the wintry sky;
This day forget your worldly cares
And lay your sorrows by.
Awake and sing,
The church bells ring,
For this is Christmas morning!

With grateful hearts salute the morn,
And swell the streams of song
That laden with great joy are borne
The willing air along;
The tidings thrill
With right good will,
For this is Christmas morning!

We'll twine the fresh green holly wreath
And make the Yule log glow,
And gather gaily underneath
The glistening mistletoe;
All blithe and bright,
By the glad firelight,
For this is Christmas morning!

Come, sing the carols old and true,
That mind us of good cheer,
And, like a heavenly fall of dew,
Revive the drooping year.
And fill us up
A wassail-cup;
For this is Christmas morning!

To all poor souls we'll strew the feast,
With kindly heart and free;
One Father owns us, and at least
To-day we'll brothers be.
Away with pride,
This holy tide,
For it is Christmas morning!

So now, God bless us, one and all,
With hearts and hearthstones warm;
And may He prosper great and small,
And keep us out of harm,
And teach us still
His sweet good will
This merry Christmas morning!

In the field with their flocks abiding,
They lay on the dewy ground,
And glimmering under the starlight
The sheep lay white around.
When the light of the Lord stream'd o'er them,
And, lo! from the heaven above
An angel lean'd from the glory,
And sang his song of love;
He sang, that first sweet Christmas,
The song that shall never cease:
"Glory to God in the highest,
On earth good will and peace!

"To you in the city of David
A Saviour is born to-day,"
And suddenly a host of the heavenly ones
Flash'd forth to join the lay.
O never hath sweeter message
Thrill'd home to the souls of men;
And the heavens themselves had never heard
A gladder choir till then;
For they sang that Christmas carol
That never on earth shall cease:
"Glory to God in the highest,
On earth good will and peace!"

And the shepherds came to the manger,
And gazed on the Holy Child;
And calmly o'er that rude cradle
The virgin mother smiled.
And the sky, in the starlit silence,
Seem'd full of the angel lay:
"To you in the city of David
A Saviour is born to-day."
O, they sang—and I ween that never
The carol on earth shall cease:
"Glory to God in the highest,
On earth good will and peace!"

A HYMN ON THE NATIVITY OF MY SAVIOUR

Ben Jonson, one of the great Elizabethan poets and dramatists, softened under the influence of the "sweet story of old" to the writing of this tender song of praise for the birth of Christ.

I SING the Birth was born to-night,
The Author both of life and light;
The angels so did sound it.
And like the ravish'd shepherds said,
Who saw the light, and were afraid,
Yet search'd, and true they found it.

The Son of God, th' eternal King,
That did us all salvation bring,
And freed the soul from danger;
He whom the whole world could not take,
The Word, which heaven and earth did make,
Was now laid in a manger.

The Father's wisdom will'd it so,
The Son's obedience knew no "No,"
Both wills were in one stature;
And as that wisdom hath decreed,
The Word was now made flesh indeed,
And took on Him our nature.

What comfort by Him do we win,
Who made Himself the price of sin,
To make us heirs of glory!
To see this Babe, all innocence,
A Martyr born in our defence;
Can man forget this story?

LITTLE CHILDREN, WAKE AND LISTEN!

To be simple in words and thought is all that a Christmas hymn need be in order to be well worth singing, for the story of Christ's coming to earth is all the sweeter for being told in the simplest of language. This little hymn for Christmas morning is well written. It is taken from Williamson's Children's Manual, which was published in 1876.

LITTLE children, wake and listen!
Songs are breaking o'er the earth;
While the stars in heaven glisten,
Hear the news of Jesus' birth.

Long ago, to lonely meadows
Angels brought the message down;
Still each year, through midnight shadows
It is heard in every town.

What is this that they are telling,
Singing in the quiet street?
While their voices high are swelling,
What sweet words do they repeat?

Words to bring us greater gladness,
Though our hearts from care are free;
Words to chase away our sadness,
Cheerless though our hearts may be.

Christ has left His throne of glory,
And a lowly cradle found;
Well might angels tell the story,
Well may we their words resound.

Little children, wake and listen!
Songs are ringing through the earth;
While the stars in heaven glisten,
Hail with joy your Saviour's birth.

JEALOUS JACK FROST

Frederic E. Weatherly, the author of this little poem, in which he describes very quaintly one of the unhappy results of the visits of Jack Frost, is a well-known writer of songs which are set to music by our leading composers.

JACK FROST went out on a wintry day,
And he heard a bird singing so blithe and gay;
And he stopped and stared with scorn on his brow
Where the little bird sang on the bare bleak bough.

"Now why are you singing, you bird?" he cried,
"I never could sing, though I've often tried."
And the little bird nodded his head in glee:
"Because I am happy, I sing," said he.

"But why are you happy?" said Jack to the bird.
"I never am happy; it's so absurd."
Then louder the little bird sang in glee:
"Because I love and am loved," said he.

Then Jack in a terrible temper flew,
And a cold, long blast on the bird he blew
And there on the ground he laid him low,
Mute and dead in the cold, cold snow.

ONCE IN ROYAL DAVID'S CITY

No Christmas hymn written in our own day is more popular than this beautiful poem by Mrs. Alexander, who was born in 1818 and died in 1895. She wrote many fine poems for children, chiefly on religious subjects. Mrs. Alexander was the wife of the Bishop of Derry.

ONCE in royal David's city
Stood a lowly cattle shed,
Where a Mother laid her Baby
In a manger for His bed;
Mary was that Mother mild,
Jesus Christ her little Child.

He came down to earth from Heaven
Who is God and Lord of all,
And His shelter was a stable,
And His cradle was a stall;
With the poor and mean and lowly,
Lived on earth our Saviour holy.

And, through all His wondrous Childhood
He would honour and obey
Love, and watch the lowly Maiden
In whose gentle arms He lay;
Christian children all must be
Mild, obedient, good as He.

For He is our childhood's pattern,
Day by day like us He grew;
He was little, weak, and helpless,
Tears and smiles like us He knew.
And He feeleth for our sadness,
And He shareth in our gladness.

And our eyes at last shall see Him,
Through His own redeeming love;
For that Child so dear and gentle
Is our Lord in Heav'n above.
And He leads His children on
To the place where He is gone.

Not in that poor lowly stable,
With the oxen standing by,
We shall see Him; but in Heaven,
Set at God's right hand on high;
When like stars His children crown'd
All in white shall wait around.

THE BIRTH OF CHRIST

There is real expression of joy and gladness in this hymn by S. C. Hamerton. It is well fitted for the voices of the young.

WAKEN, Christian children!
Up and let us sing,
With glad voice, the praises
Of our new-born King.

Up! 'Tis meet to welcome
With a joyous lay;
Christ, the King of Glory,
Born for us to-day.

Come, nor fear to seek Him,
Children though we be,
Once He said of children:
"Let them come to Me."

In a manger lowly
Sleeps the Heavenly Child;
O'er Him fondly bendeth
Mary, mother mild.

Far above that stable,
Up in heaven so high
One bright star outshineth,
Watching silently.

Fear not then to enter,
Though we cannot bring
Gold, or myrrh, or incense,
Fitting for a King.

Gifts He asketh richer,
Offerings costlier still;
Yet may Christian children
Bring them if they will.

Brighter than all jewels
Shines the modest eye;
Best of gifts, He loveth
Infant purity.

Haste we then to welcome,
With a joyous lay,
Christ, the King of Glory,
Born for us to-day.

RING OUT, WILD BELLS

One of Lord Tennyson's greatest works is a very long poem called In Memoriam. It is really a whole series of poems in which, over a period of several years, the poet mourns for the loss of a dear friend, Arthur Henry Hallam. The varying seasons of each year are described by the poet, and always he expresses the thoughts which the seasons brought to him while still thinking of his dead friend. In these verses it is the end of the year again and we see that the poet is rejoiced by the music of the midnight bells that ring out the Old Year and ring in the New. He seems to hear in them promise of a brighter day, and, oh, it would be well with the world if the glorious vision of the poet were to come true. But it is ennobling thus to have our minds filled with such thoughts as Tennyson found in the music of the bells.

RING out, wild bells, to the wild sky,
The flying cloud, the frosty light;
The year is dying in the night;
Ring out, wild bells, and let him die.

Ring out the old, ring in the new,
Ring, happy bells, across the snow;
The year is going, let him go;
Ring out the false, ring in the true.

Ring out the grief that saps the mind,
For those that here we see no more;
Ring out the feud of rich and poor,
Ring in redress to all mankind.

Ring out a slowly dying cause,
And ancient forms of party strife;
Ring in the nobler modes of life,
With sweeter manners, purer laws.

Ring out the want, the care, the sin,
The faithless coldness of the times;
Ring out, ring out my mournful rhymes
But ring the fuller minstrel in.

Ring out false pride in place and blood,
The civic slander and the spite;
Ring in the love of truth and right,
Ring in the common love of good.

Ring out old shapes of foul disease;
Ring out the narrowing lust of gold.
Ring out the thousand wars of old;
Ring in the thousand years of peace.

Ring in the valiant man and free,
The larger heart, the kindlier hand;
Ring out the darkness of the land,
Ring in the Christ that is to be.

DEATH OF THE OLD YEAR

In this fine poem Lord Tennyson sounds none of the Christmas joy bells, nor yet a welcome to the New Year. His purpose is to express the feeling of sorrow that comes uppermost in all our hearts as the Old Year goes out. By picturing the Old Year as an actual friend who dies, the poet succeeds in making us feel keen sorrow for its departure.

FULL knee-deep lies the winter snow,
And the winter winds are wearily sighing:
Toll ye the church bell sad and slow,
And tread softly and speak low,
For the Old Year lies a-dying.

Old Year, you must not die;
You came to us so readily,
You lived with us so steadily,
Old Year, you shall not die.

He lieth still; he doth not move;
He will not see the dawn of day.
He hath no other life above.
He gave me a friend, and a true, true love,
And the New Year will take 'em away.

Old Year, you must not go;
So long as you have been with us,
Such joy as you have seen with us,
Old Year, you shall not go.

He froth'd his bumpers to the brim;
A jollier year we shall not see.
But tho' his eyes are waxing dim,
And tho' his foes speak ill of him,
He was a friend to me.

Old Year, you shall not die;
We did so laugh and cry with you,
I've half a mind to die with you,
Old Year, if you must die.

He was full of joke and jest,
But all his merry quips are o'er.
To see him die, across the waste
His son and heir doth ride post-haste.
But he'll be dead before.

Everyone for his own.
The night is starry and cold, my friend,
And the New Year blithe and bold, my friend,
Comes up to take his own.

How hard he breathes! over the snow
I heard just now the crowing cock.
The shadows flicker to and fro;
The cricket chirps; the light burns low;
'Tis nearly twelve o'clock.

Shake hands before you die.
Old Year, we'll dearly rue for you;
What is it we can do for you?
Speak out before you die.

His face is growing sharp and thin.
Alack! our friend is gone.
Close up his eyes; tie up his chin;
Step from the corpse, and let him in
That standeth there alone,

And waiteth at the door.
There's a new foot on the floor, my friend,
And a new face at the door, my friend,
A new face at the door.

LITTLE VERSES FOR VERY LITTLE PEOPLE

BOUNCE BUCKRAM, velvet's dear;
Christmas comes but once a year.

RIDE away, ride away, Johnny shall ride,
And he shall have pussy-cat tied to one side,
And he shall have little dog tied to the other,
And Johnny shall ride to see his grandmother.

MY maid Mary
She minds her dairy,
While I go a-hoeing and mowing each morn.

Merrily run the reel
And the little spinning-wheel,
Whilst I am singing and mowing my corn.

WHAT is the rhyme for porringer?
The King he had a daughter fair,
And gave the Prince of Orange her.

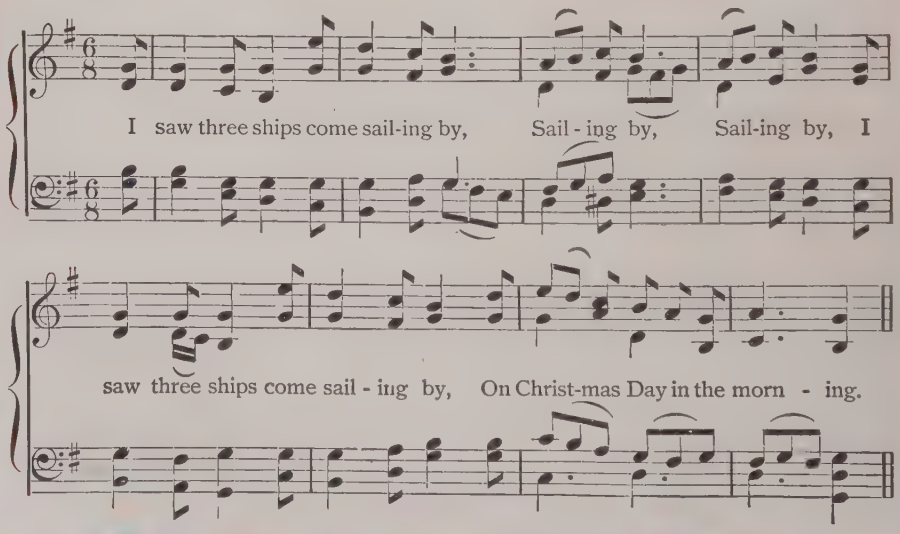
I SAW THREE SHIPS

I SAW three ships come sailing by,
Sailing by, sailing by,
I saw three ships come sailing by,
On Christmas Day in the morning.

And what do you think was in them then,
In them then, in them then?
And what do you think was in them then,
On Christmas Day in the morning?

Three pretty girls were in them then,
In them then, in them then,
Three pretty girls were in them then,
On Christmas Day in the morning.

And one could whistle and one could sing,
And one could play on the violin,
Such joy there was at my wedding,
On Christmas Day in the morning.

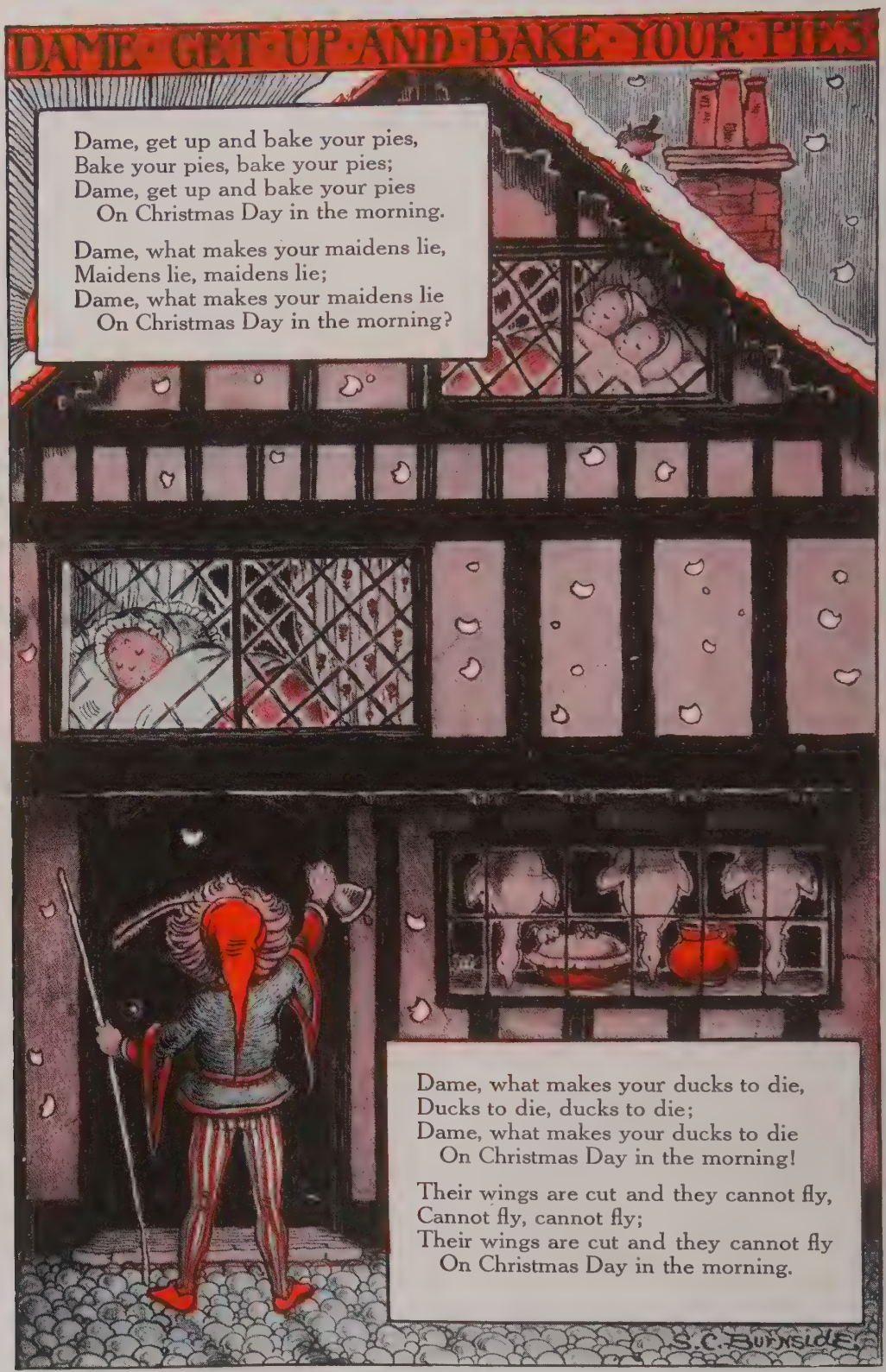


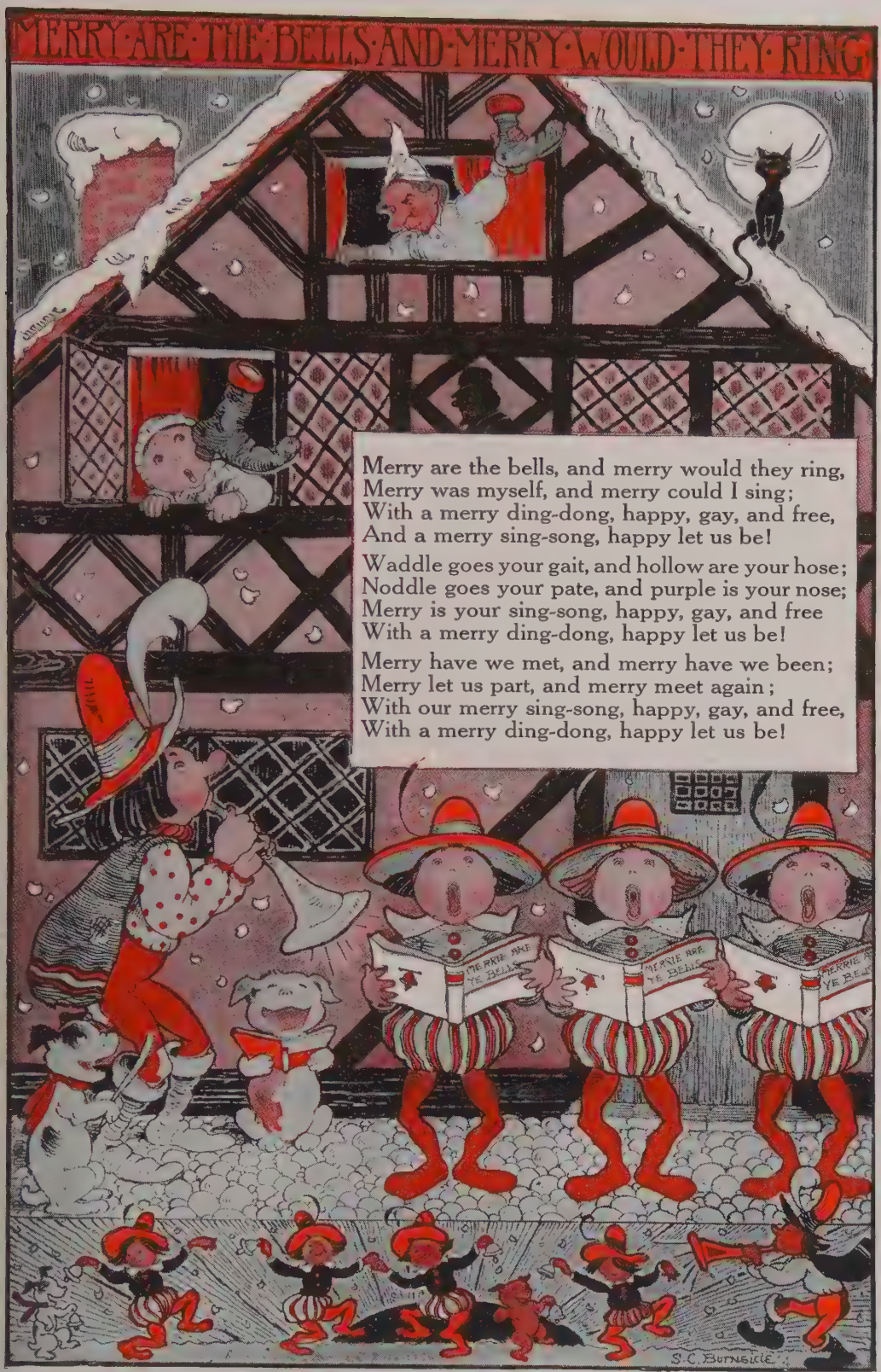
HE comes in the night! He comes in the night!
He softly, silently comes;
While the little brown heads on the pillows so white
Are dreaming of bugles and drums.
He cuts through the snow like a ship through the foam,
While the white flakes around him whirl;
Who tells him I know not, but he findeth the home
Of each good little boy and girl.

His sleigh it is long, and deep, and wide;
It will carry a host of things,
While dozens of drums hang over the side,
With the sticks sticking under the strings.
And yet not the sound of a drum is heard,
Not a bugle blast is blown,
As he mounts to the chimney-top like a bird,
And drops to the hearth like a stone.

The little red stockings he silently fills
Till the stockings will hold no more;
The bright little sleds for the great snow hills
Are quickly set down on the floor.
Then Santa Claus mounts to the roof like a bird,
And glides to his seat in the sleigh;
Not the sound of a bugle or drum is heard
As he noiselessly gallops away.

He rides to the East, and he rides to the West,
Of his goodies he touches not one;
He eateth the crumbs of the Christmas feast
When the dear little folks are done.
Old Santa Claus doeth all he can,
This beautiful mission is his;
Then, children, be good to the little old man,
When you find who the little man is.


DAME GET UP AND BAKE YOUR PIES
Dame, get up and bake your pies,
Bake your pies, bake your pies;
Dame, get up and bake your pies
On Christmas Day in the morning.
Dame, what makes your maidens lie,
Maidens lie, maidens lie;
Dame, what makes your maidens lie
On Christmas Day in the morning?
Dame, what makes your ducks to die,
Ducks to die, ducks to die;
Dame, what makes your ducks to die
On Christmas Day in the morning!
Their wings are cut and they cannot fly,
Cannot fly, cannot fly;
Their wings are cut and they cannot fly
On Christmas Day in the morning.
S.C. BURNSIDE


MERRY ARE THE BELLS AND MERRY WOULD THEY RING
Merry are the bells, and merry would they ring,
Merry was myself, and merry could I sing;
With a merry ding-dong, happy, gay, and free,
And a merry sing-song, happy let us be!
Waddle goes your gait, and hollow are your hose;
Noddle goes your pate, and purple is your nose;
Merry is your sing-song, happy, gay, and free
With a merry ding-dong, happy let us be!
Merry have we met, and merry have we been;
Merry let us part, and merry meet again;
With our merry sing-song, happy, gay, and free,
With a merry ding-dong, happy let us be!
S. C. Burnside

MARLEY'S GHOST APPEARING TO OLD SCROOGE

When Scrooge went home on Christmas Eve, after denouncing everything connected with Christmas, he was visited by the ghost of his late partner, who told him that if he valued his future happiness he must pay heed to what he would be shown by the spirits of Christmas who were coming to visit him.

A STORY OF CHARLES DICKENS

A CHRISTMAS Carol in Prose is only a short book written for the Christmas season, but it is one of the most charming stories Dickens ever gave us. It is the best Christmas story, and Dickens was the author who made stories of this kind popular. He wrote it for the Christmas of 1842, and it touched the hearts of all who read it. "It seems to me a national benefit, and to every man and woman who reads it a personal kindness," said Thackeray, the novelist. The writer of A Christmas Carol is indeed the "Father Christmas" of literature, and so long as we celebrate the joyous season we shall remember his delightful story, which breathes the very spirit of good-will. Harry Furniss has especially illustrated this story for us.

THE OLD MAN NAMED SCROOGE

BEING A CHRISTMAS CAROL IN PROSE

CONTINUED FROM 5905

THERE was a very dreadful old man named Ebenezer Scrooge. What a fine name for a horrid old man! There never was such an old grumpy, frumpy, ill-tempered, sour, unfriendly old man. He had been in partnership for many years with one named Marley, so his firm was known as Scrooge & Marley. But Marley had been dead for seven years—"as dead as a doornail"—and Scrooge lived alone and shunned everybody.

He had a clerk in his office named Bob Cratchit, and he only paid the poor fellow—who had a wife and four children—fifteen shillings a week, a wage that scarcely fed his family.

The bare, ill-furnished office that Cratchit sat in was more like a tank than a room, and it was as much as his place was worth to attempt to keep himself warm by putting on a good fire, even in the coldest weather.

Old Scrooge grudged every piece of coal that was burned, and kept the coal-box in his own room. He never gave poor Bob a holiday except on Christmas Day, and he hated the very thought of that day coming round. You really never heard of such a nasty, sour-tempered old man.

His nephew, Fred, was just the reverse—a jolly, good-natured young man, who determined that he would always wish his uncle a merry Christmas, no matter how he was snubbed by him. It was Christmas Eve, and into the office of Scrooge & Marley popped the jolly nephew, saying brightly to old Scrooge: "A merry Christmas, uncle! God save you!"

"Bah!" said Scrooge. "Humbug!"

"Christmas a humbug, uncle!" said Scrooge's nephew. "You don't mean that, I am sure."

"I do," said Scrooge. "Merry Christmas! What right have you to be merry? What reason have you to be merry? You're poor enough!"

"Come, then," returned the nephew gaily; "what right have you to be dismal? What reason have you to be morose? You're rich enough!"

Scrooge, having no better answer ready on the spur of the moment, said "Bah!" again, and followed it up with "Humbug!"

"Don't be cross, uncle!" said the nephew.

"What else can I be," returned the uncle, "when I live in such a world of fools as this? Merry Christmas! Out upon merry Christmas! What's Christmas-time to you but a time for paying bills without money; a time for finding yourself a year older, but not an hour richer; a time for balancing your books and having every item in 'em through a round dozen of months presented dead against you? If I could work my will," said Scrooge indignantly, "every idiot who

OLD FEZZIWIG'S CHRISTMAS BALL

The Ghost of Christmas Past shows Scrooge his old master Fezziwig making everybody happy at Christmas.

goes about with 'Merry Christmas' on his lips should be boiled with his own pudding, and buried with a stake of holly through his heart. He should!"

"Uncle!" pleaded the nephew.

"Nephew!" returned the uncle sternly. "Keep Christmas in your own way, and let me keep it in mine!"

"Keep it!" repeated Scrooge's nephew. "But you don't keep it!"

"Let me leave it alone, then," said Scrooge. "Much good may it do you! Much good it has ever done you!"

And so he went on, denouncing Christmas in a frightful way, and refusing utterly to say a good word about it or anybody or anything, until his good-natured nephew went away. Two gentlemen who called later in the day for a subscription on behalf of the poor were, of course, turned out without a penny. There were workhouses. What more did the poor want? Old Scrooge would think himself mad to waste his money on them or on anybody, and poor Bob Cratchit was told to be in all the earlier to work on Boxing Day, as he was having Christmas Day off, which was equal to stealing so much of his employer's time. What an old skin-flint!

THE STRANGE THINGS THAT HAPPENED TO OLD SCROOGE ON CHRISTMAS EVE

Now, when the old curmudgeon went home that night to the dismal chambers he occupied—they had formerly been the rooms of his dead partner Marley—he was amazed to notice that the knocker on the door was—old Marley's face! This was queer. But the old fellow went up the dark stairs as boldly as he could, and entered his dark, dreary, dismal rooms. Darkness was cheap, and so he liked it, the old miser!

"Sitting-room, bedroom, lumber-room. All as they should be. Nobody under the table, nobody under the sofa; a small fire in the grate, spoon and basin ready, and the little saucepan of gruel upon the hob, for Scrooge had a cold in his head. Nobody under the bed; nobody in the closet; nobody in his dressing-gown, which was hanging up in a suspicious attitude against the wall. Lumber-room as usual—old fire-guard, old shoes, two fish-baskets, washing-stand on three legs, and a poker.

"Quite satisfied, he closed the door, and locked himself in—double-locked himself in, which was not his custom. Thus secured against surprise, he took off his cravat, put on his dressing-gown and slippers, and his nightcap, and sat down before the fire to take his gruel."

As he sat looking at the low fire, he suddenly realized that every tile about the grate had on it a copy of old Marley's face staring at him. He now began to feel very creepy, you may be sure.

HOW THE GHOST OF OLD MARLEY CAME TO SCROOGE AND WHAT IT TOLD HIM

There was an old bell high up in the room, and it began to ring, while a noise downstairs made him start, and the sound of someone coming to his room made him quiver in every limb, and, behold, the ghost of old Marley walked into his dismal room, with a long, heavy chain dragging from his waist.

When Scrooge summoned up courage to speak to the ghost it told him that the chain was all the misdeeds and unkind actions of which he had been guilty, and that Scrooge himself was making a chain which would be an awful weight to him when he was dead. The ghost also told him that he would be visited by three spirits, the first coming at one o'clock in the morning; and if he valued his future peace he had better take the advice he had given him and see what the spirits would show him. But old Marley's ghost he would see no more. When it vanished, Scrooge looked out of his window and saw many such phantoms, with heavy chains about their waists, like that which had burdened Marley. Denouncing the whole thing as "humbug," he lay down on his bed as he was, and was soon asleep.

When he awoke it was still dark, and he had no idea of the time. But while he lay on the bed peering anxiously into the gloom, the curtains were drawn aside by a hand, and the first of the promised spirit-visitors stood before him.

THE GHOST OF CHRISTMAS PAST AND WHAT IT SHOWED THE MISER

"It was a strange figure—like a child; yet not so like a child as like an old man, viewed through some supernatural medium, which gave him the appearance of having receded from the view, and being diminished to a child's proportions. Its hair, which hung about its neck and down its back, was white, as if with age; and yet the face had not a wrinkle in it,

and the tenderest bloom was on the skin. The arms were very long and muscular; the hands the same, as if its hold were of uncommon strength. Its legs and feet, most delicately formed, were, like those upper members, bare. It wore a tunic of the purest white, and round its waist was bound a lustrous belt, the sheen of which was beautiful. It held a branch of fresh green holly in its hand, and, in singular contradiction of that wintry emblem, had its dress trimmed with summer flowers. But the strangest thing about it was that from the crown of its head there sprung a bright, clear jet of light, by which all this was visible; and which was doubtless the occasion of its using, in its duller moments, a great extinguisher for a cap, which it now held under its arm."

THE YEARS ARE ROLLED AWAY AND OLD FEZZIWIG'S BALL COMES BACK AGAIN

He told the miserly old man that he was the Ghost of Christmas Past, and before Scrooge knew it he found himself away many miles, led by the spirit, and back many weary years, seeing his own boyhood's home, as well as many happy scenes he had long forgotten, but was delighted to see again. He was shown some jolly Christmases of long ago, when he was a youth; and, best of all, the spirit took him to the warehouse where he had been an apprentice. When they peeped in Scrooge cried out, on seeing an old gentleman in a Welsh wig, sitting at a high desk: "Why, it's old Fezziwig! Bless his heart, it's Fezziwig alive again!"

"Old Fezziwig laid down his pen, and looked up at the clock, which pointed to the hour of seven. He rubbed his hands, adjusted his capacious waistcoat, laughed all over himself, from his shoes to his organ of benevolence, and called out in a comfortable, oily, rich, fat, jovial voice: "'Yo, ho, there! Ebenezer! Dick!'

OLD SCROOGE SEES HIMSELF AGAIN AS A HAPPY YOUNG MAN IN THE LONG-AGO

"Scrooge's former self, now grown a young man, came briskly in, accompanied by his fellow-'prentice.

"'Dick Wilkins, to be sure!' said Scrooge to the ghost. 'Bless me, yes. There he is. He was very much attached to me, was Dick. Poor Dick! Dear, dear!'

"'Yo ho, my boys!' said Fezziwig. 'No more work to-night. Christmas Eve, Dick! Christmas, Ebenezer! Let's have the shutters up,' cried old Fezziwig, with a sharp clap of his hands, 'before a man can say Jack Robinson!'

"You wouldn't believe how those two fellows went at it. They charged into the street with the shutters (one, two, three), had 'em up in their places (four, five, six), barred 'em and pinned 'em (seven, eight, nine), and came back before you could have got to twelve, panting like race-horses.

"'Hilli-ho!' cried old Fezziwig, skipping down from the high desk with wonderful agility. 'Clear away, my boys—lads, and let's have lots of room here! Hilli-ho, Dick! Chirrup, Ebenezer!'

"Clear away! There was nothing that they wouldn't have cleared away, or couldn't have cleared away, with old Fezziwig looking on. It was done in a minute. Every movable was packed off, as if it were dismissed from public life for evermore. The floor was swept and watered, the lamps were trimmed, fuel was heaped upon the fire, and the warehouse was as snug and warm and dry and bright a ball-room as you would desire to see upon a winter's night.

THE MERRIEST, JOLLIEST CHRISTMAS PARTY THAT EVER WAS!

"In came a fiddler with a music-book, and went up to the lofty desk and made an orchestra of it, and tuned like fifty stomach-aches. In came Mrs. Fezziwig, one vast substantial smile. In came the three Miss Fezziwigs, beaming and lovable. In came the six young followers whose hearts they broke. In came all the young men and women employed in the business. In came the housemaid, with her cousin, the baker. In came the cook, with her brother's particular friend, the milkman. In came the boy from over the way, who was suspected of not having board enough from his master, trying to hide himself behind the girl from next door but one, who was proved to have had her ears pulled by her mistress. In they all came, one after another—some shyly, some boldly, some gracefully, some awkwardly, some pushing, some pulling. In they all came, anyhow and everyhow.

"Away they all went, twenty couples at once; hands half round and back again the other way; down the middle and up again; round and round in

various stages of affectionate grouping; old top couple always turning up in the wrong place; new top couple starting off again as soon as they got there; all top couples at last, and not a bottom one to help them. When this result was brought about, old Fezziwig, clapping his hands to stop the dance, cried out 'Well done!' and the fiddler plunged his hot face into a pot of porter, especially provided for that purpose. But, scorning rest, upon his reappearance he instantly began again, though there were

THE MERRY CHRISTMAS DINNER AT THE HOME OF POOR BOB CRATCHIT

no dancers yet, as if the other fiddler had been carried home, exhausted, on a shutter, and he were a bran-new man resolved to beat him out of sight, or perish."

And so the jolly party went on until eleven o'clock, when Fezziwig and his wife wished them all a merry Christmas and parted from them as happy as happy could be. Scrooge was so delighted that he began to wish he could meet Bob Cratchit at once; he would not be so rough with him now. But the ghost took him to another Christmas, when old Marley was lying at death's door and Scrooge was lonely in his office, while happiness was reigning in the home of an old sweetheart of his, who had fortunately married a kindly, good-natured man. There's no saying what else the Ghost of Christmas Past would have shown him had Scrooge not managed to get the extinguisher in his hand, which the ghost had carried all the time, and, by pressing this down upon it, to put out the light of the ghost like a snuffed candle. And he had barely time to reel into bed before he fell into a heavy sleep.

When he awoke again it was still dark outside, but his room was filled with a mysterious ruddy light. The bell struck one. No ghost appeared. Scrooge was trembling with fear. After a while he ventured to get up, and shuffled in his slippers to the door.

"The moment Scrooge's hand was on the lock a strange voice called him by his name, and bade him enter. He

obeyed. It was his own room. There was no doubt about that. But it had undergone a surprising transformation. The walls and ceiling were so hung with living green that it looked a perfect grove, from every part of which bright, gleaming berries glistened.

THE JOLLY GIANT WHO WAS THE GHOST OF CHRISTMAS PRESENT

"The crisp leaves of holly, mistletoe, and ivy reflected back the light, as if so many little mirrors had been scattered there; and such a mighty blaze went roaring up the chimney as that dull hearth had never known in Scrooge's time, or Marley's, or for many and many a winter season gone. Heaped up on the floor, to form a kind of throne, were turkeys, geese, game, poultry, brawn, great joints of meat, sucking-pigs, long wreaths of sausages, mince-pies, plum-puddings, barrels of oysters, red-hot chestnuts, cherry-cheeked apples, juicy oranges, and seething bowls of punch, that made the chamber dim with their delicious steam. In easy state upon this couch there sat a jolly giant, glorious to see, who bore a glowing torch, in shape not unlike Plenty's horn, and held it up, high up, to shed its light on Scrooge, as he came peeping round the door.

"'Come in!' exclaimed the ghost. 'Come in and know me better, man!'

"Scrooge entered timidly, and hung his head before this spirit. He was not the dogged Scrooge he had been, and though the spirit's eyes were clear and kind, he did not like to meet them.

"'I am the Ghost of Christmas Present,' said the spirit. 'Look upon me!'"

HOW THE GHOST TOOK OLD SCROOGE TO THE HOME OF BOB CRATCHIT

This jolly ghost took shivering old Scrooge away on the wings of the wind through the Christmas streets, showed him the home of poor Bob Cratchit, where, with all their poverty, the clerk and his wife and children were happy and delighted around the Christmas goose, and the great steaming plum-pudding, which Mrs. Cratchit had saved for so long and cooked so carefully. And after the dinner was over Bob proposed the toast: "A merry Christmas to us all, my dears; God bless us!" which Mrs. Cratchit, Peter, Belinda, and Martha all echoed, while Tiny Tim said last of all, "God bless us every one!"

Tim was Cratchit's youngest child, a little cripple whose life seemed to hang only by a thread, he was so weak and tiny. Scrooge who had cruelly said that the death of such children was a good riddance, was now anxious to know if there was any hope for Tiny Tim. He was almost as concerned about him now as if he had been his own child.

But the spirit whirled him on through a colliery village, where poor folk were rejoicing around Christmas fires; to a lighthouse in the stormy sea, where lonely men still wished each other a happy Christmas; to the home of his nephew, Fred, where everything was happiness, and even his own name was spoken not with contempt, but with sorrow and sympathy, because he was not enjoying the season of good-will.

To many other homes and places the Ghost of Christmas Present took him, showing him misery and want as well as happiness and plenty. But as the bells struck twelve the spirit vanished, and a new and different figure came to him. This was the third and last of his strange, ghostly visitors.

THE APPEARANCE OF THE GHOST OF CHRISTMAS YET TO COME

"I am in the presence of the Ghost of Christmas Yet To Come?" said Scrooge. The spirit answered not, but pointed onward with its hand. "You are about to show me shadows of the things that have not happened, but will happen in the time before us," Scrooge pursued. "Is that so, Spirit?" The upper portion of the garment was contracted for an instant in its folds, as if the spirit had inclined its head. That was the only answer he received.

The mission of this spirit was soon begun, for it showed him his own death and how not a soul was there to mourn his loss; how his death was rather a cause of happiness in some quarters than a sense of loss; but it also showed him how Tiny Tim might die and leave many friends to sorrow for him, because they had loved him, while his memory would endure in their hearts.

In short, old Scrooge had now come to be so affected by all the visions which the three spirits had shown him that he was utterly changed, and when at length the Ghost of Christmas Yet To Come brought him to a neglected gravestone with his own name on it, he

was no longer the Scrooge that had turned his nephew out of his office without wishing him a merry Christmas. He appealed to his spirit-guide for mercy and promised to alter his life in the future.

"'I will honor Christmas in my heart and try to keep it all the year. I will live in the Past, the Present and the Future. The spirit of all three shall strive within me. I will not shut out the lessons that they teach. Oh, tell me I may sponge away the writing on this stone!' In his agony he caught the spectral hand. It sought to free itself but he was stronger in his entreaty and detained it. The spirit, stronger yet, repulsed him. Holding up his hands in a last prayer to have his fate reversed, he saw an alteration in the phantom's hood and dress. It shrunk, collapsed and dwindled down into a bedpost."

Great was Scrooge's delight when he awoke to find it was Christmas Day, and that he was not too late to begin at once. Never did a jollier old gentleman set out to make people happy on Christmas Day. He sent the biggest prize turkey that ever was sold to Bob Cratchit's—sent it in a cab, if you please, to be in time. He met one of the gentlemen who had called for the subscription for the poor, and gave him so big a donation that the gentleman was amazed. "A great many back payments included in it," old Scrooge explained to him. He hied himself to the home of his nephew and staggered Fred and his wife and her sister and all the others who came to the Christmas party by being the jolliest of the lot.

"Wonderful party, wonderful games, wonderful unanimity, won-der-ful happiness!"

He went early next morning to his office. Bob Cratchit was late. Scrooge pretended to be very angry with him for a little, and then playfully dug him in the ribs and said that, as a punishment, he was going to raise his salary!

"A merry Christmas, Bob!" said Scrooge, with an earnestness that could not be mistaken, as he clapped him on the back. "A merrier Christmas, Bob, my good fellow than I have given you for many a year! I'll raise your salary, and endeavor to assist your struggling family, and we will discuss your affairs this very afternoon over a Christmas bowl of smoking bishop, Bob! Make up the fires, and buy another coal-scuttle before you dot another *i*, Bob Cratchit!"

Scrooge was better than his word. He did it all, and infinitely more; and to Tiny Tim who did not die he was a second father.

After Scrooge, the miser, had been visited by the spirits of Christmas, and changed from a miserly into a kind-hearted old man, he went to his office on Boxing Day and, pretending to be angry with his clerk, Bob Cratchit, for coming in late, he dug him playfully in the ribs, saying he would punish him by raising his wages.

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 6573.

THE CUCKOO-PINT

The cuckoo-pint has a great rolled-up leaf, like a monk's hood, inside which form the bright red berries that are called lords-and-ladies.

THE COWSLIP

We all know the yellow funnel-shaped flowers of the cowslip, with their fragrance and store of honey. In this country the cowslip is a garden flower.

COMMON MEADOW CLOVER

The clover may be magenta, pink or, rarely, whitish. It is sweet-scented and grows in fields and roadsides throughout Canada and the United States. June meadows bright with clover resound with the murmur of happy bumblebees.

THE LADYSMOCK

The ladysmock, or milkmaid, is common in American marshes in spring. The blossoms, ranging from pale purple to white, have a dainty appearance and are similar in form to those of the wallflower. Country people eat the leaves as salad.

"Those pale pink stars with hearts of gold."

FLOWERS OF THE POETS

CONTINUED FROM 5884

WHEN we are reading either prose or poetry of English authors, from the earliest times to Shakespeare, and until now, we constantly find references to certain flowers. These are very familiar to English people, but for many of us the quaint old names rarely call forth any mental picture of the plants, except, perhaps, of a few that are grown in our gardens, such as the daisy and the daffodil.

Yet around some of them a wealth of legend and folklore has arisen, and their very names, various as they may be, reveal glimpses of history and custom, or of the keen observation of nature that has contributed toward their naming. Many plants received their titles when fairies were abroad in the land and needed thimbles and stools and rings to dance in. Others won their names by their colors or by their uses, real or imagined, and by their fancied resemblance to something else.

As our shadbush blooms when the shad are running, so the Cuckoo-pint of Great Britain enters into its prime when the cuckoos begin to call in the budding trees. It is an Arum not unlike our jack-in-the-pulpit or skunk cabbage, and, strange as it may seem, is a distant relative of the exquisite white calla. It has a great many common names, as Lords-and-ladies and Wake-robin, and the fruit is called snake's meat, poison berries, and various other scornful names. Toward the end of January or early in February the great glossy green arrow-shaped leaves of the cuckoo-pint break through the earth, at first rolled up, but soon expanding, and then many of them show purplish black blotches. The Latin name *Arismœma* means "bloody arm" and refers to these dark purple stains of the spathe. An old legend claims that at the time of the Crucifixion

Beneath the cross it grew,
And in the vase-like hollow of the leaf,
Catching from that dread shower of agony
A few mysterious drops, transmitted thus
Unto the groves and hills their healing stains,
A heritage for storm or vernal shower
Never to blow away.

It is not until late in March or early in April that the pale yellow-green hoods come up and open their fronds, revealing the purplish poker-like pin. Most people regard this hood as the flower of the cuckoo-pint, but it is really only an outside covering. If we tear it carefully aside, we shall find that

the real flowers, in great numbers, are clustered round the lower part of the pin. Looking at the hood, we shall see that it has a sort of waist, which divides the open upper part from the closed lower part, and, inside, the two parts are farther separated by a fringe of hairs standing out from the pin, or pintle, as it is named.

The flowers are below these hairs, very small, and without either sepals or petals. First there is a crowded band of stamens, and below these a similar band of crowded pistils. The hairs of the fringe above them all bend slightly downward. The pistils are mature before the stamens are ready to shed their pollen; and those who have carefully studied the plant and its peculiarities tell us that when the pistils are ready the cuckoo-pint sends forth an unpleasant odor, which is attractive to certain small hairy winged flies that fly to it and, seeing the purple pintle, think it is something in which they can lay their eggs.

Finding out their mistake, the flies follow the scent to the lower part of the hood. The fringe of hairs bends to let them pass, but springs back at once to shut them in, for the hairs will not bend upward. When autumn comes we see the result of the work of these little flies in the bright red berries clustered around the remains of the pintle.

THE BUTCHER'S BROOM, ONE OF THE EARLIEST FLOWERS

One of the earliest flowers to appear in Great Britain is the Butcher's Broom, which may be looked for at any time between November and March. The plant is a prickly shrub, the leaves of which are reduced to thin scales that soon drop off and can rarely be found. But instead of leaves the butcher's broom has flattened out its twigs until they are egg-shaped, with a very sharp hard point at the upper end. Most people take these for leaves, but if we find the plant in blossom we shall see that the flowers come out of the centre of these flattened twigs, which are known as cladodes. No plant produces flowers from its leaves. The flowers are not more than a quarter of an inch across, and consist of three sepals and three petals, because they belong to the Lily Family. They are pale greenish yellow, with a violet-purple centre.

The stiff prickly cladodes and the red berries have caused the plant to be called in some places the Knee-holly. Underground there is a thick fleshy creeping stem, or rootstock. This is the only shrubby lily in Great Britain.

THE DAFFODIL, CALLED DAFFYDOWNDILLY BY THE POETS

In some British woodlands in March or April we may come across great spaces that are turned to gold by the nodding trumpets of the Daffodil, or Lent Lily.

The poet Wordsworth, sauntering along one day, somewhat pensive and sad, came upon a glorious sight:

> A host of golden daffodils
> Beside the lake, beneath the trees,
> Fluttering and dancing in the breeze.
>
> Continuous as the stars that shine
> And tremble on the milky way,
> They stretched in never-ending line
> Along the margin of a bay.
> Ten thousand saw I at a glance,
> Tossing their heads in sprightly dance.

Over and over again do the poets refer to the early blossoming of the daffydowndilly:

> When daffodils begin to peer,—
> With heigh! the doxy o'er the dale,—
> Why, then comes in the sweet o' the year:
> For the red blood reigns in the winter's pale.

Though it looks more like a lily than does the butcher's broom, it does not belong to that family, but to the Amaryllis Family, to which the snowdrop also belongs. The long strap-like leaves, with straight sides, spring from a pear-shaped bulb, and from their middle rises the tall pipe-like stem, or scape, bearing a single bud that is covered by a papery skin, or spathe.

As the bud swells, this wrapper is split down one side and pushed back. There are three sepals and three petals joined together at their base, but the six of them are alike in form and color, and they are collectively known as the perianth. This is of the beautiful pale yellow tint that is so familiar to us in the primrose; but the mouth of the perianth-tube has grown out into a rich yellow trumpet with a toothed and crinkled mouth. There are six stamens and one pistil.

THE FAIR PALE PRIMROSE, LOVELIEST OF SPRING FLOWERS

The rather pale Primrose, "the firstling of the year," comes with the daffodil, and is the most renowned of the Primrose Family.

> First came the primrose,
> On the bank high.

THE HAREBELL

The harebell, with its pretty little blue flowers, is the true bluebell of Scotland. It is called harebell because it grows where hares live, but the true name of the flower is heather-bell.

THE HONEYSUCKLE

Few flowers are more deliciously fragrant than the honeysuckle, or "luscious woodbine," which in some parts of Scotland used to be placed in cow-sheds to prevent the cattle from being bewitched.

THE WILD THYME

The fragrant thyme, with its rose-colored flowers, was formerly regarded as a cure for "melancholy and frenzy," and used as medicine. It is much visited by bees. The leaves are small.

COMMON MEADOW BUTTERCUP

The buttercup, with bright, shining yellow flowers, grows in meadows and on roadsides in Canada and the United States, where it has been naturalized from Europe. Children should not bite the stem.

THE PRIMROSE

No wild flower is better known than the simple, beautiful primrose. It is abundant in early spring before other flowers are out, and its name means "first rose."

THE WILD HYACINTH

This lovely spring flower spreads carpets of exquisite blue in the openings of the woodlands in the British Isles, in the months of April and May. Its common name is bluebell.

THE DEADLY NIGHTSHADE

This plant merits its name, for people who eat the berries soon die. The flowers are in the form of dull purple bells. A preparation of deadly nightshade called belladonna is used for medicinal purposes.

THE HEARTSEASE

The heartsease, or wild pansy, is really a violet, but its color varies from white to yellow and purple, and usually it has two or three of these tints together. It was formerly used as a medicine, but its place has now been taken.

THE BUTCHER'S BROOM

The butcher's broom is so called because butchers used to preserve meat from rats and mice by covering it with this plant. The small greenish white flowers are succeeded by scarlet berries.

THE COMMON RED POPPY

The scarlet poppy is, perhaps, the most brilliantly colored British flower. In fields of grain, where it grows abundantly, its bright scarlet flowers form a striking contrast to the golden waving grain.

THE DAFFODIL

Where the daffodil is found it grows in abundance. Country children in England are fond of "going daffying," as they call daffodil-picking. Daffydowndilly is the old English country name, and many are the songs written in its honor.

THE FOXGLOVE

The handsome, stately foxglove, with its flowers like crimson bells, has many names, such as Thimble-flower, Fairy's Petticoat and Fairy-cap. Foxglove means "folk's," or "fairy's, glove." The leaves are broad and long.

It has a salver-form corolla, with a widely flaring, five-parted brim. Five stamens spring from the tube of the corolla; sometimes from near its base, with a long pistil, sometimes from near its top, with a short pistil. In the latter case they are called "thrum-eyed," in the former "pin-eyed." The lower stamens, in the one form, are just about on the same level as the stigma in the form with a short pistil. Thus a bee, down-thrusting his proboscis in the one, gets it well dusted with pollen in just the place to have it brushed off by a pistil in a similar position, and the upper stamens powder the proboscis for the long pistil. "Hence we see that by this beautiful arrangement, insects must carry the pollen of the long-styled form to the short-styled, and vice versa."

THE SWEET-SCENTED FLOWERS OF THE MEADOW CLOVER

The Clover, or "Meadow Honeysuckle," belongs to the Pea Family. Its head consists of a number of little florets, each shaped somewhat like a tube with a mouth toward the outside. Only bees and butterflies, with their long tongues. can enjoy the brimming wells of nectar waiting for them at the base of the tube. The bee is the more profitable visitor, for as it sips it depresses the lower lip of the flower and gets well dusted with the pollen or yellow powder. This, in the course of visiting the next flower, the bee transfers to its stigmas, and thus the clover is fertilized and increased.

"To live in clover" is certainly, from an insect's point of view, a luxurious and rapturous experience. In the course of history the clover has been given many mystic qualities. To find a four-leaved clover is accounted all sorts of good fortune. Watch the leaves at evening and you will find that they fold downward, the side ones like two hands folded in prayer, the end one lowered over them. It is believed that the plant does this to protect its sensitive surfaces from cold.

THE LADYSMOCK, OR MILKMAID, OF THE MEADOW

It is April and May in England

When daisies pied, and violets blue,
And Ladysmocks all silver-white,
And cuckoo-buds of yellow hue
Do paint the meadow with delight.

The four-petaled flowers of the Ladysmock which, in spite of Shakespeare, are sometimes mauve, are of similar form to those of the wallflower, and the two plants belong to the same family, but the leaves are very different from those of the wallflower. The flowering stem is not sent up until spring, and on it there are much shorter leaves with the leaflets long and slender instead of round. The seeds are in long slender pods like those of the wallflower.

THE COWSLIP, BELOVED RETREAT OF THE FAIRIES

About the time the milkmaid is in flower we ought also to find the Cowslip. Its near relative, the primrose, is a plant of the woods, and is not particular as to the kind of soil, so long as there is plenty of leaf-mold above it. But the cowslip is fond of heavy soils, such as clay-loam and chalk-loam; consequently it is not to be found on light sandy soil, but is a distinct meadow plant. In some districts the meadows are thickly studded with clumps of cowslip, their yellow flowers standing high above their rosettes of leaves. "Yellow cowslips paint the grass."

The cowslip flowers grow in a cluster right at the summit of the juicy flower-stem, which has no leaves at all and is therefore called a scape. The five sepals are united into a calyx, and the five petals into a corolla, the teeth of the calyx and the lobes of the corolla showing the number of parts of which they are made up. There are five stamens attached to the corolla-tube, and the pistil has a rounded stigma like the head of a pin. As in the primrose, there are two kinds of flowers, one with the anthers of the stamens almost closing the mouth of the corolla-tube and the stigma almost halfway down the tube, and the other with the stamens halfway down the tube and the stigma at its mouth. All the flowers on one part are of one kind only, the two forms never growing on the same plant.

The "cowslips wan" are the legendary retreat of fairies, who creep into them during showers.

THE FRAGRANT BLUEBELL OF THE ENGLISH POETS

People living in America are likely to be puzzled by the frequent references to Bluebells in English books. On this side of the water the bluebells of Scotland are those that we think of first—those nodding campanulas that dance, not only on the heaths of Scotland, but on our northern cliffs and rocky hillsides. However, in England, quite another flower is some-

THE BLACK BRYONY

This is a climbing plant that twines round the support by which it rises. The flowers are yellow-green, and the roots are used to cure bruises.

THE PURPLE HEATH

This plant, known also as the fine-leaved heath, is the commonest of all the British heaths. It grows as a bush, with narrow leaves and purple flowers.

THE CROSS-LEAVED HEATH

This heath is more general than the purple heath, but it does not grow so profusely, and is therefore less known. It gets its name from its leaves growing in fours round the stem as in a cross.

THE COMMON BROOM

The broom has been described by the poet as "yellow and bright as bullion unalloyed." Where other plants will not thrive, it clothes the landscape with beauty. It is often confounded with the furze.

times meant, the delicate hyacinth-like, fragrant Squills that we often find in our gardens—generally known as Scillas—and that, blooming very early in spring, "purple all the ground with vernal flowers."

How many million Aprils came
Before I ever knew
How white a cherry bough could be,
A bed of squills, how blue!

THE HAREBELL, OR HEATHER-BELL, OF SCOTLAND

"Mourn, little harebells o'er the lea," cries Burns, referring to the flower that is the darling of Scotland, that overtops the heaths and the heather. Elsewhere he speaks of "Heather-bells," which is the proper name for them; but the Scots shortened the name into Hea'er-bell, and the English know it as Harebell. It is so delicate and fragile that Scott, in describing his Lady of the Lake, writes:

E'en the slight harebell
Raised its head
Elastic from her fairy tread.

The pendent position of the harebell not only favors the bees which alight by clinging to the pistil and reaching far into the bell to get at the nectar at the base of the stamens, but prevents undesirable visitors from entering. It also, by forming a roof, protects the pollen from rain.

And this is very important, for the whole tribe of bell-flowers, or campanulas, are capable of self-pollination, so that if insects fail to cross-fertilize them, they can still perfect the seed. Other campanulas are also called bluebells. One kind, having run wild, sends up tall spines of violet bells along shady roadsides.

THE ENAMELING OF THE MEADOWS BY THE BUTTERCUP

As spring advances its pageant glows ever more gorgeously. Who that has seen the sheen of buttercups beneath an elm tree will ever wholly forget the sight! Blue sky, running water, white clouds, the tender spring green of trees—it is a scene that has inspired many a poet.

And all the meadows, wide unrolled,
Were green and silver, green and gold,
Where buttercups and daisies spun
Their shining tissues in the sun.

Most of us have used the buttercup to test our fondness for butter! Farmers do not care for these lovely flowers in the pastures, because cattle will not eat its acrid, caustic stem and leaves. The earliest buttercup is the Bulbous Buttercup, which by storing up nourishment underground all winter steals a march on its fibrous-rooted sister that accumulates hers in the spring. It is a low and more hairy plant, but very like the tall buttercup in other respects and, like it, a naturalized European immigrant.

THE STATELY SPIRE OF THE FOXGLOVE

Near them, perhaps, will shoot up into tall spires, "stately Foxgloves fair to see," from among their large wrinkled leaves; and more than half of the four-foot length of stem is covered with the large purple-spotted crimson bells. The stamens and pistil are so carefully placed upon the upper wall that the portly blumblebee, as it crawls in to get at the nectar, cannot fail to bring and carry off the pollen; while smaller insects are kept out by fringes of long hairs that stick in their faces. One foxglove plant produces a million and a half of seeds! There is much questioning as to the origin of this name. In several languages, the likeness of each flower to a glove-finger or a thimble has been noticed, and in England it was supposed that fairy-folk donned them for headgear, while witches used them for thimbles. A useful medicine called digitalis is extracted from the velvety leaves of the foxglove, although the plant, as a whole, is poisonous.

THE DEADLY NIGHTSHADE, OF WHICH WE MUST BEWARE

Another poisonous plant, but also medicinal, is the Deadly Nightshade, and all must beware of touching its big black, cherry-like berry. This plant is bushy, about three feet high, with broad oval leaves. The drooping flowers are bell-shaped, greenish purple in color, and are produced singly. The whole plant is poisonous, and even the plucking of a spray may cause trouble to our eyes, so we must not touch it.

Foxglove and nightshade, side by side,
Emblems of punishment and pride.

THE HEARTSEASE, WHICH RESEMBLES THE PANSY

But the little Heartsease is not poisonous.

By scattered rocks and turbid waters shifting,
By furrowed glade and dell,
To feverish men thy calm, sweet face uplifting,
Thou stayest them to tell

The delicate thought that cannot find expression,
For ruder speech too fair,

That, like thy petals, trembles in possession,
And scatters on the air.

Its flowers are seldom much more than an inch across, and often smaller; their shape and markings are just like garden pansies. At the base of the leaves there appear to be smaller leaves, but they are really stipules. In the pansy they are large and leaf-like, so they are commonly looked upon as leaves. Usually the petals are white with yellow and purple lines, but sometimes the upper petals are purple and the lower ones yellow.

The purple lines all run to the entrance to the nectar-tube, where there are two yellow spots, so that long-tongued insects shall not miss the way.

"I know a bank where the wild thyme blows," said Oberon, and a wonderfully odorous and bee-haunted bank it doubtless was. While it grows in its evergreen low tufts it is very fragrant and pretty. Even its pale flowers standing thickly at the tips of the branches are of a pleasing "rosy" tint. The Garden Thyme is very similar, but comes from the Mediterranean shores. It is one of the aromatic Mint Family.

The typical flower of the British grainfields is the Scarlet Poppy. In June, when the wheat stalks have not yet reached their full height, many grainfields appear from a distance to have nothing but poppies in them, and are a sheet of blazing scarlet. During the World War the poppy of the Belgian fields of battle won for its species a glorious immortality. No longer the symbol of forgetfulness, to-day it stands to remind the world of sacrifice willingly offered.

In Flanders fields the poppies blow;
Between the crosses, row on row,
They mark our place.

. . . . . .

Take up our quarrel with the foe;
To you from failing hands we throw
The torch; be yours to hold it high.
If ye break faith with us who die,
We shall not sleep, though poppies grow
In Flanders fields.

In contrast to the poppy is the charming Guelder Rose, which attracts attention to its fruit-bearing treasures by the circle of gay, but otherwise useless, flowers. By gradually increasing the number of these snowy, sterile florets, the florists have built up the white globes that are so familiar in old-fashioned gardens.

There is no more beautiful flower song in literature than that which Tennyson gives us in Maud. The lover is waiting in a flower-scented garden in the warm blackness of the summer night,

And the woodbine spices are wafted abroad,
And the musk of the rose is blown.

The music of the revelers at the hall has been continuous.

All night has the casement jessamine stirred
To the dancers dancing in tune;

until the lover in him gets impatient and turns to the silent watchers beside him and says

to the lily, "There is but one
With whom she has heart to be gay.
When will the dancers leave her alone?
She is weary of dance and play."

Then the revelers depart and still she does not come, and, his passion rising, he complains

to the rose, "The brief night goes
In babble and revel and wine."

Still standing by the garden lake, with the sound of the rivulet falling, he beseeches Maud, who tarries so long.

The slender acacia would not shake
One long milk-bloom on the tree;
The white lake-blossom fell into the lake
As the pimpernel dozed on the lea;
But the rose was awake all night for your sake,
Knowing your promise to me;
The lilies and roses were all awake,
They sighed for the dawn and thee.

Queen rose of the rosebud garden of girls,
Come hither, the dances are done,
In gloss of satin and glimmer of pearls,
Queen lily and rose in one;
Shine out, little head, sunning over with curls,
To the flowers, and be their sun.

There has fallen a splendid tear
From the passion-flower at the gate.
She is coming, my dove, my dear;
She is coming, my life, my fate;
The red rose cries, "She is near, she is near";
And the white rose weeps, "She is late";
The larkspur listens, "I hear, I hear";
And the lily whispers, "I wait."

Bryant has beautifully described the passing of the year in his Death of the Flowers:

The windflowers and the violets, they perished long ago,
And the brier-rose and the orchids died amid the summer glow;
But on the hills the golden-rod, and the aster in the wood,
And the yellow sunflower by the brook, in autumn beauty stood,
Till fell the frost from the clear cold heaven, as falls the plague on men,
And the brightness of the smile was gone, from upland glade to den.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 6273.

A MODERN WIZARD

This picture of Thomas Alva Edison, in his vigorous old age, was taken in front of the first motor that he made when he was working out the system of electric lighting by incandescent lights, which have taken the place of arc-lights. The little motor is carefully preserved in his power house, amid all the powerful machinery of which it was the forerunner. It is difficult to say which is the most important branch of electricity with which Edison has been connected.

© Brown Bros.

WHAT THIS STORY TELLS US

THIS is the story of a man who by hard work has gained a place in the admiration of his fellow-countrymen which has been seldom surpassed. Few people are able to do such work as Thomas Alva Edison has done. We must remember, however, that if at any time in his early life he had been content with the work that he had done, he might have remained all his life a magazine-vendor on a train or a telegraph-operator. If he had been content to stand still, not only his country and the world, but he himself, would have been the loser. He did not stand still, for he was not satisfied with himself, and so he is known the world over. It is probable that he would be well content to be known as a man who has always done his best, and even though we cannot all make great inventions, that is a title that anyone may deserve. We never know what we can do until we try, and so this story of a modern wizard who found out, by trying, what he could do, is of great interest and encouragement to us, though we may never accomplish the wonders he has achieved.

A MODERN WIZARD

CONTINUED FROM 5920

SUPPOSE you are a boy or a girl living on a farm remote from a large town. You may sit on your veranda in the summer evening reading The Book of Knowledge by electric light, while your mother sits gently swaying in her rocker, her needlework in her hands, listening to the voice of one of the great singers. Your father sits smoking, now and then getting up to change a record on the phonograph from which the sweet sounds come pouring out. Perhaps it is a winter evening; then you may telephone to a party of young friends to come and dance to the music of a good orchestra, or, gathered around a cozy fire, you may listen to a recital by a great violinist. If you have been reading of the music written by the great musicians you may turn to your phonograph so that your ears may become familiar with the sweet and stirring songs, simple melodies, dances or great sonatas and symphonies that they have written. Perhaps it is Friday evening. Home lessons are laid aside until Saturday; there is a "movie" theatre in the nearest village, or moving pictures are given in the schoolhouse. Then for an hour or two you are taken to places of interest in our own country, or in places far distant; you laugh heartily over a comedy, or your heart aches over some sad, pathetic story. A great parade is held in a distant city, and within a few days the men and women will march down toward you on the picture screen. You see the launching of a proud ship, the forging of a giant anchor, a carnival held in New Orleans or in Rome, or perhaps a wedding procession in Bombay.

Here we are going to read something about the man to whom we owe the fact that our lives are so much richer than the lives of our grandfathers and grandmothers, or even our fathers and mothers when they were young.

Thomas Alva Edison worked out his inventions by known laws of science. He had studied these laws, so that he was able to apply them to make real the visions of his imagination. Yet he had few advantages and little help, and his story is one of those that inspire us to great effort to cultivate the talents that have been given to each one of us.

He was born in February, 1847, in the little village of Milan, in Ohio. His parents were poor because his father did not keep to a settled occupation. Mr. Edison, senior, had the

same kind of mind as his wonder-working son—the kind of mind that is called versatile, that can easily turn from one thing to another. He had not learned, however, that it is wise for a man with a versatile mind to find out how to do one thing thoroughly before he turns to another, and so he was not successful.

Thomas Alva Edison was a quiet, thoughtful little boy, but very inquisitive and always wanting to know how things were done. He was not very strong, however, and was not sent to school until he was quite a big child. When he did go, his teacher, who does not seem to have been very wise, thought him stupid because he asked so many questions. So his mother, who had herself been a teacher, took him away from school at the end of two months and taught him at home. With so kind and loving a teacher he made rapid progress; and above all, he learned to think. His mother had some good books, which he learned to enjoy; and when he was ten years old he read Gibbon's Decline and Fall of the Roman Empire and Hume's History of England. About that time he began to study an encyclopedia. It was probably from the encyclopedia that he first learned to take an interest in chemistry.

By this time his parents, who had moved with him to Port Huron, Michigan, were able to indulge him in his love for making experiments. He bought some books, made a little laboratory in the cellar of his home, and there laid the foundation of his knowledge of chemistry.

When he was twelve years old he decided to start out in life for himself, and he became a newsboy on the train which ran from Port Huron to Detroit. Such a newsboy had never been seen before. He was given a corner in the baggage car in which to keep his stocks of newspapers, magazines and candy. To this corner he moved his little laboratory and library of chemical books, and when he was not engaged in his business, went on with his experiments. Still time hung heavy on his hands, and to fill it up he bought a printing-press and type and published on the train a weekly newspaper filled with local news, stories of things that happened on the railway and notes of the markets.

All went well for two or three years. But when he was in his sixteenth year, one day a phosphorus bottle was jarred off one of his shelves and broke on the floor. It set fire to the baggage car, and in his anger at the danger to his train the conductor not only put the boy off the train, but soundly boxed his ears. That was the most unfortunate part of the accident, for as a result of the boxing Edison gradually lost his hearing and became almost totally deaf. His stock was lost, but an act of great bravery on his part brought to his aid a new resource and opened up a new field for him to work in.

He was standing one day on the platform of the station at Clemons, Michigan, watching a train come in, when he saw the station agent's little boy on the track right in front of the oncoming engine. Another moment and the child would have been crushed, but Edison sprang to the track, seized the little one in his arms, and rolled with him to one side, just in time to escape the wheels. To show his gratitude the baby's father offered to teach Edison telegraphy. The offer was gratefully accepted, and now that his career as a train newsboy was closed, he turned to his new accomplishment as a means of making a living.

He worked at telegraphy for some years, first in Port Huron, Michigan, then at Stratford, Canada, and a little later in the western states, and finally in Boston. At the same time he spent all his spare moments studying chemistry and electricity and experimenting on improved telegraph apparatus. It was during these years that he first turned his attention to duplex telegraphy, but through no fault of his own he was unable to sell his invention, and the matter dropped for a time.

In 1869, when he was in his twenty-second year, he went to New York. He arrived penniless in the city; but he was a good telegraph-operator, and was fearless of the future. And now a strange thing happened. He applied to the Gold and Stock Telegraph Company for work, and while he was waiting for a reply part of the apparatus broke down. No one knew what was the matter, and everything was in confusion until Edison said he could set the machine at work again. Permission was given him to try, and at the end of two hours work in the office was going on as if nothing had happened. Edison was asked if he would accept a position at a salary of three hundred dollars a month and, needless to say, he accepted.

WHERE ELECTRIC POWER IS GENERATED

Trains entering and leaving the Grand Central Terminal in New York are hauled by electric locomotives. The power is generated miles away in large power houses. This is the Port Morris station on Long Island Sound, so located because coal can be easily and cheaply brought to it, and there is also an abundant supply of water to condense the steam from the many great boilers.

Each of these large turbo-generators can develop about 7,000 horse power. The current is sent by cable to substations. They deliver it to the third rail, which you see beside the tracks. Edison did some important work on the use of electricity in transportation, but his attention was turned to other things.

Photos, courtesy New York Central Lines.

His new position gave him money and leisure for new inventions. In a little over a year he sold his telegraph inventions for a large sum of money. This enabled him once more to set up in business for himself. He built a factory in Newark, New Jersey, for the manufacture of telegraph apparatus, and since then his chief business has been that of making inventions.

The first great invention was the quadruplex system of telegraphy, about which you have read in the story of the telegraph, on page 6052. About the same time Edison made an improvement in the transmitter of the telephone which made it easier for the voice-waves to travel, and improved the usefulness of the telephone very much.

It was at about the same time that he invented the phonograph. The idea of an instrument which would "write sound" and reproduce it had been thought of before by scientists, though it is doubtful if Edison knew of their efforts to make such an instrument. At any rate, he was the first to make an instrument which would work, and even he did not know that it would work until he heard it repeat the words that he had shouted into it. He says himself that when he put the reproducer in place and the instrument shouted back to him the words "Mary had a little lamb," he was never so taken aback in his life.

Edison patented his invention, which from the first excited the wonder of the world. Of course, like all first things, it was crude, and the sounds that it gave back were harsh. For the time he had to lay it aside, for other work pressed, but others took it up, and from his parent idea the phonograph, dictaphone and other instruments were invented. Later on, when he had more leisure, he commenced work on it again, and worked out an instrument which gives back every beautiful vibration from voice or instrument. The dictaphone, as you know, is a little instrument into which busy men and women dictate letters or documents or directions for work. Then the dictaphone-operator causes the instrument to send the stored-up sound-waves into her ear, and from its dictation the letters or instructions can be written.

When electricity was first used for illumination only large arc-lights were used. The lamps sputtered and scattered sparks, and the light was so harsh that it could be used only for street-lighting and large buildings, such as factories, drill halls and the like. Such a thing as incandescent lights, which make possible the use of softly shaded lamps, or indirect lighting in our homes, or the brilliant illumination of churches, concert halls and theatres, was not even thought of. This was the work for which Edison put aside the work on his phonograph. He believed that a number of lights could be supplied from one distributing wire, and he believed that the light could be improved so that its use would be a common thing, so he invented the incandescent lamp, about which you may read on page 5938. He spent a couple of years over this work, and to perfect his system improved dynamo machines, and invented a whole scheme of distributing electricity so that it might be used for light, heat and power. The result is that you may sit on your veranda and read by a lamp lighted by electricity, the power for which has been generated perhaps at a waterfall miles away. The same power sends electricity to work and light mills and factories, to drive railway trains, and to light the streets of villages and towns that would otherwise be dark.

Now we come to the moving pictures, where again Edison took up an idea which others had had before him. From the story of the moving pictures, which is told on page 6593, you may see that while it cannot be said that he invented the moving pictures, the invention on which the moving pictures are based is his.

These inventions are only a small part of the work done by this wonderful man. He has invented a new storage battery, giant rolls to crush rocks, a kiln for use in making Portland cement, and numbers of other things which he needed to help him in the larger work in hand.

When the World War broke out he found himself in danger of being cut off from his supply of carbolic acid for his factories at West Orange, New Jersey, so he devised a way of making it for himself, and also for making the benzol from which the carbolic acid is produced. For two years he gave his services to the United States Government and experimented and reported on many problems.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6235.

JOHN MAYNARD, PILOT

CONTINUED FROM 5738

IN thick darkness the great steamer was creeping through dangerous but smooth waters toward the end of her journey. The passengers and most of the crew were asleep in their berths. The captain was taking his well-earned rest in his cabin. On the bridge was the pilot, a man named John Maynard, who had left his wife and the son whom he loved much better than his own life, to bring this great ship safely into harbor.

It was one of those dark nights at sea when it is impossible to catch a glimpse of the vast ocean through which ships make their way. Not a star shone in the sky. The little disks of light made by the portholes perished in the wall of darkness inclosing the ship. The only sounds in the darkness were the grinding of the paddles and the deep, low murmur of the smooth sea.

So smooth, so gentle was the ocean, that none could dream of disaster. It was a fitting night for the end of a dangerous voyage, for the peace and rejoicing of a home-coming.

But of a sudden a terrible cry arose above the sea—a cry of "Fire!"

Gone now was the darkness. Every face was visible. Every line of terror could be seen in that frightful glare. And another sound was added to the moan of the sea and the noise of the paddles—the rushing, roaring, hissing sound of fire that leaped in a writhing cloud of sparks to the sky.

The captain cried out in a loud voice: "Listen! In ten minutes more we may reach land. Our lives may yet be saved. It rests with the pilot. If he can hold on at his post we shall reach the land." He turned around, and called: "John Maynard, are you there?"

A quick answer came from the bridge: "Ay, ay, sir!"

In an instant, despair was turned into hope. That answer was so strong, so sure, and it had come so quickly. Only ten minutes. They were saved! John Maynard could see laughing women kissing their babies, and fathers smiling into the eyes of their sons.

The great ship, now a driving shape of flame, cut through the smooth and dangerous water at its highest speed, a race against fire!

Would they reach the land in time? With every turn of the paddles they were nearer to safety; but with every second the flames increased in fierceness.

What of the pilot? Was he still safe at the wheel?

"Are you there, my lad?" cried the captain.

There was no answer.

The passengers felt their hearts sink, and a new terror possessed them.

But, just as they abandoned hope the answer came—so slow, so choked, so difficult that it was hard to believe that the same man spoke.

"Sir, I'll try," said John Maynard.

The thoughts of the passengers, at that instant, were turned from the faithful pilot. The lights on land suddenly stood out before them in the distance. A loud cheer ascended from the decks. They were saved. The race against fire had been won. Land was near; houses were visible; the towers of churches, the names of shops and the lamps in the street came into view. Boats could be seen putting out to them.

John Maynard, from the bridge, could see mothers clutching their children to their hearts. His own little son, his well-beloved, was asleep at home far away. The moving mass of roaring flame, which once had been a ship, reached the harbor.

Passengers threw themselves into the waiting boats. Not a thought was given to the pilot. On the sides of the harbor was gathered a dense multitude, watching the spectacle of a great ship on fire.

When everyone was saved, the boiler exploded with a deafening roar, and John Maynard was hurled into eternity.

Many men who stood on that flaming deck remembered to their dying day, as the most vivid impression of their lives, the look on John Maynard's face as he held to his post in the blinding smoke and the fiercely raging fire.

A POACHER'S SILENCE

MANY years ago a gamekeeper was killed in the east of England, and two poachers were arrested for the crime and brought to trial. There seemed to be no difficulty in finding out which of the prisoners was guilty. One of the men confessed that he and he alone had done the horrible deed.

But in spite of this, for some reason or other there was a general feeling that he was innocent, and the trial excited very great interest. When the verdict was given, and the judge had pronounced sentence of death, the friends of the prisoner bestirred themselves, and, raising the plea that he suffered from a deformity of the neck which would make it a torture to hang him, they succeeded in getting a respite.

But after the respite had been granted, the law ordered a medical examination of the prisoner, and none of the doctors could find any reason why he should not meet the punishment for his crime. He was, therefore, for the second time condemned to death.

Nevertheless, his friends were still utterly unconvinced that he was guilty, and immediately set about getting up fresh petitions for his reprieve. So numerous and so earnest were these petitions that the law again granted a respite. This time the poacher was sentenced to penal servitude for life.

Think what those words mean—"penal servitude for life." They mean that a man ceases to be a man and becomes a number; that every to-morrow has the same soul-killing monotony as yesterday; that no friend may come near; and that the life of the world is shut out by frowning walls.

Perhaps this poacher many times wished that the law had put him to death, for he lay in prison day after day, week after week, month after month, for nearly thirty years. Then he was released. He went into prison a strong and vigorous man, with dark hair, bright eyes and ruddy skin; he came out white and bowed and marked forever with the gray pallor of the prison cell.

And when he came out and found that his fellow-poacher was dead, he told the story of his crime. It was not he, but his fellow-poacher, who had killed the keeper—struck him down with the butt of the gun and thrown the body into a pond. He himself had had no hand in the crime.

But why had this man taken upon himself the guilt? Why had he twice heard himself condemned to be hanged, and then for nearly thirty years of awful torture held his peace? The answer shows us that even in rough-lived men there is a soul of goodness. This English poacher held his peace because the real murderer was a married man with a wife and children dependent upon him for support. He himself was unmarried. And so, for the other man's wife and children, this simple but great-hearted poacher did what he could, offering his life that they might be spared want and suffering.

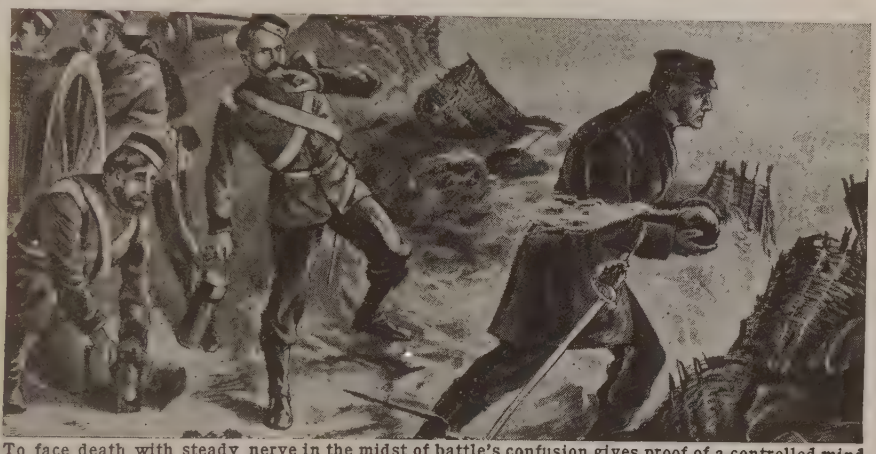
THE MAN WHO CARRIED DEATH

FORTUNATELY the days have passed away when the majority of people thought of war as something grand and glorious. Even those who believe that war is sometimes necessary agree that, whatever may be the cause that leads to fighting and bloodshed between nations, war is undoubtedly one of the greatest evils that can happen to any people. And yet the annals of war tell of many splendid and heroic deeds—deeds not merely of fierce daring in the destruction of the enemy, but of courage and endurance in the saving of life.

During the Crimean War a gallant deed of this kind was performed by Captain William Peel, the commander of one of the British warships, whose men had landed to take part in the fighting on shore. Captain Peel and his men were sent to a certain place where the guns were keeping up a constant fire upon the enemy's position. Suddenly the ammunition was found to have given out, but a number of men at once volunteered to go and bring the ammunition to the battery, although to do so was to run into the greatest danger, as Russian shells were falling and bursting all around. At last the boxes of powder and shot were brought to the battery, and the men were hastily unpacking them, when right into the midst dropped a large shell from the Russian lines. The fuse was burning, and in a moment or two the whole battery must have been blown to pieces. The men stopped in their work, and looked at the shell as though fascinated, expecting every second that the shell would burst and destroy them.

But Captain Peel was a man of action and of great presence of mind. Without a moment's hesitation, or a thought of his own safety, he rushed across the battery, seized the shell, and ran with it to the side of the battery.

The other men found their voices in a moment, and shouted: "The fuse is burning! Look out, the shell will burst!" But Captain Peel continued to run with the shell away from where the others were standing, and, raising it high above his head, hurled it over the earthworks that protected the guns.



To face death with steady nerve in the midst of battle's confusion gives proof of a controlled mind and a staunch spirit. To take death in one's hand so as to save others from its peril gives proof of self-forgetting heroism. Captain William Peel's gallant act is a shining example of such heroism.

Scarcely had the shell left his hands when it exploded with a terrific crash. A moment or two later and the brave captain would have sacrificed his own life in the effort to save his men, for when the shell fell into the battery Captain Peel could easily have escaped; but his courage, energy and presence of mind saved the whole of the band of men who were unloading the ammunition and serving the guns.

For this gallant deed Captain Peel was awarded the coveted Victoria Cross. Is there any honor or reward too great to be bestowed on the man who could so utterly forget himself for the sake of others? Is there any distinction high enough? Rather, does not he, superb in his heroism, lift the honor itself to a higher plane of value?

THE PICTURE OF A GOLDEN DEED

A YOUNG Scotch minister went one day to visit the birthplace of Thomas Chalmers in an ancient and obscure town on the Firth of Forth. When he had examined this house, he and his companion entered an inn for refreshment. The room into which he was shown had its walls covered with absurd pictures, such as shepherdesses with crooks and sailors home for the holidays. But over the mantelpiece was a picture of quite another kind, making a very strange contrast with the rest. This picture represented the gloomy interior of a cobbler's shop. The cobbler was seated on his stool—an old man with spectacles pushed up over his brow, a shoe between his knees and a hammer in his hand. The massive forehead and firm mouth suggested strength of character and an iron resolution. But under his bushy eyebrows two of the kindest eyes in all the world beamed with benevolence on a half-circle of ragged boys and girls grouped before the old man with lesson-books in their hands. The young Scotch minister read the inscription, which told how John Pounds, a cobbler in Portsmouth, took pity on the multitude of poor ragged children left by ministers and magistrates and ladies and gentlemen to go to ruin in the streets; how like a good shepherd he gathered in the wretched outcasts; how he taught them and trained them for God; and how, while earning his daily bread by the sweat of his brow, he had rescued from misery and saved to society not less than five hundred of these children. The young minister was the famous Dr. Guthrie, and this humble picture of John Pounds led him to become the apostle of the Ragged School movement. "I felt ashamed of myself," he related afterward. "I well remember saying to my companion: 'That man is an honor to humanity, and deserves the tallest monument ever raised within the shores of Britain.' I took up the man's history, and I found it animated by the spirit of Him who had compassion on the multitude." John Pounds was a clever man besides, and, like Paul, if he could not win a child any other way, he won him by art. He would be seen chasing a ragged boy along the quays and compelling him to come to school, not by the power of a policeman but by the power of a hot potato. Often on a cold winter morning he used this bait to draw a child to his little workshop, which was also his schoolroom. He loved children, and knew what a treat a baked potato is to a hungry child. When the day comes on which honor shall be given to whom honor is due, we can fancy the crowd of those whose fame poets have sung and to whose memory monuments have been raised, parting like the Red Sea while this poor obscure old man steps forward past the great, the noble and the mighty of the land, to receive the especial notice of Him who said: "Inasmuch as ye have done it unto one of the least of these my brethren, ye have done it unto Me." This is an example of the great influence of a picture. By seizing Dr. Guthrie's imagination this picture became a great influence in the lives of many thousands.

John Pounds, of Portsmouth.

The picture that helped Dr. Guthrie.
From the painting in the possession of Sir John Kirk.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 6291.

WHAT THIS ARTICLE TELLS US

EVERY American and Canadian boy knows something about baseball, though not all realize how important the game has become in the United States. Millions of dollars are invested in fields and stands where the games are played. Factories are kept busy making balls, bats, masks and uniforms for players, and many men make their living from the game in different ways. You will now learn something of the importance of the game. The chief rules are given in simple language, so that two teams of boys may play without further instruction. You can, however, get the book of rules for a few cents. The description will also enable sisters and mothers to understand the game.

AMERICA'S NATIONAL GAME

CONTINUED FROM 5984

ONE of the first desires of every boy is to play with a ball of some sort. He will make one of cloth if he cannot get any other kind. Think how many of our most interesting games are played with a ball or balls. One can mention, among others, tennis, football, polo, ninepins, basket-ball, cricket and, greatest of all, baseball.

The last one named can fairly be called the national game of the United States. In every part of the country, when the weather permits, hundreds of thousands of boys and young men play at every opportunity. It is the most important game at the colleges and boarding-schools during the spring months, and thousands of men play the game for regular salaries. A good player may receive several thousands of dollars for the season.

Nearly every large town or city has one or more professional teams. This means that they play baseball as a business and receive pay for it. They play with the teams from other cities, and millions of dollars are invested in buildings and grounds for the purposes of the game. In the large cities games draw thousands of spectators.

The oldest organization now in baseball is the National League, which is composed of clubs in New York, Chicago, Pittsburgh, Philadelphia, St. Louis, Cincinnati, Brooklyn and Boston. The American League is made up of clubs in Philadelphia, Detroit, Cleveland, New York, Chicago, Boston, Washington and St. Louis. These are called the "major leagues."

The International League is next in importance. It is composed of clubs in Toronto, Canada, and in Baltimore, Buffalo, Rochester, Jersey City, Newark, Syracuse and Reading, in the United States. There are many other organizations in other cities of both countries, and some of them play excellent ball. The team which wins the greatest percentage of the games played in each league is the champion of that league. The major league winners play for the championship of the United States. Sometimes the winner in a minor league plays a series of games with the winner in another league.

Though the game is played more in the United States than anywhere else, it is very widely played in Canada, and some of the best players are Canadians. The game has gained a foothold in Australia, Japan, the Philippine Islands and Cuba. It has not been much played in Europe.

Below will be found a description of the game written in simple language.

A regulation baseball field consists of a level stretch of ground upon which is marked out, by white lines, a square, the sides of which measure 90 feet in length. The space within these lines is called the *diamond* or the *infield*. For boys' use it is usually smaller. At each of the four angles is set a *base*. The position of the black square in the picture on the next page is called the *home* plate; it is set level with the surface of the ground. For important games it is made of whitened rubber and measures 17 inches across. The three other bases are flat bags filled with sawdust, fastened to pegs driven into the earth. The bases at the other corners of the diagram are known, respectively, as *first base*, *second base* and *third base*.

The lines running from the home plate to first base and third base are prolonged, as you may see. All territory between them is called *fair* ground; the space behind and outside of the diamond is called the *outfield*.

A game is played by two teams of nine players on each side. These are known as follows: pitcher, catcher, first baseman, second baseman, shortstop, third baseman, right fielder, centre fielder and left fielder. The pitcher and the catcher constitute the *battery*. The three basemen and the shortstop make up the infielders. The three other players are the outfielders.

When a team is *in the field* its players take the positions indicated in the diagram. The catcher's place is a few feet behind the home plate. The pitcher stands near the centre of the diamond, at equal distances from first and third base and just short of an imaginary line joining them. This region is known as

the *pitcher's box*. The first and third basemen take positions a little inside of and back of their bases. The second baseman stands slightly back of his base and somewhat over toward first base. The station of the shortstop is near the point indicated, between second and third bases. The three outfielders are placed more or less as indicated by the black dots in the diagram. They play close in or far back, according to the batter. If he is accustomed to drive the ball a long distance, they will go back, too, so that they may not have to run too far to catch the ball. The entire team is thus arranged to cover the greatest amount of fair ground.

Each player has a padded glove as a protection in stopping thrown or batted balls. The ball

is made of yarn wound about a rubber and cork centre and covered tightly and smoothly with leather. The regulation ball weighs between 5 and 5¼ ounces, and measures between 9 and 9¼ inches in circumference. For boys' games a smaller ball is better. The bat is a round wooden club, not longer than 42 inches, nor over 2¾ inches in diameter at the thickest part. The gloves or mitts of the catcher and the first baseman are larger and more heavily padded than those of the other players; in fact, there is no restriction governing their size. The catcher, especially, needs a very heavy glove. In addition, he is provided with a mask made of heavy wire to protect his face, and a padded or inflated chest-protector to guard against injury from the swift throws of the pitcher or foul tips from the bat.

The two teams alternate at bat and in the field. The side at bat endeavors to force runners around the bases against the opposition of the team in the field. Every man making the circuit of the bases and arriving at the home plate safely scores one *run* for his side. When, however, three men of the team at bat have been *put out* by the opposing fielders, then the side which has been at bat must take the field, while the players of the side which has been in the field now take their turn at bat. When they have had three men put out they in turn take the field, while the other side comes to bat again. One such period in which each team has one turn at bat and one in the field is called an *inning*. Nine innings constitute a game, which is won by the team with the largest total score of runs. In case of a tie, as many extra complete innings are played as are necessary to give one team or the other the lead. If one team has made more runs in eight innings than the other has made in nine, the other half of the ninth inning is not played. The members of each team take their turns at bat in regular rotation, according to the batting-order, which is arranged by the captain at the beginning of the game and must be followed throughout. When a substitute replaces a player he fills the same place in the batting-order as the man whose place he has taken.

The game begins then, with one team in the field and the other prepared to bat. The home team has the choice of going first to the bat or to the field. Behind either the catcher or the pitcher is usually the position of the *umpire*, whose duty it is to render decisions on all plays. The first batter takes his position at the side of

the home plate, facing it, but with his head turned to watch the opposing pitcher. It is now the problem of the pitcher to throw the ball so that it will pass over the home plate and yet make it difficult for the hitter to meet it squarely with his bat; or else to make the batter think that the ball will cross the plate, and thus force him to strike at a ball out of his reach.

WHAT IS A STRIKE?

If the pitcher is successful in delivering the ball over any part of the home plate, at a height between the knee and the shoulder of the batsman, and the latter does not hit it, it is called a *strike* whether the batsman has struck at it or not. Again, if the batsman strikes at a pitched ball without hitting it, a strike is likewise called, whether the ball has passed over the plate or not. Three strikes, if the catcher holds the ball on the third, render the batter out. A *foul* is also counted as a strike unless it would make the third one.

On the other hand, if the ball, after being delivered by the pitcher, fails to pass over any part of the plate, or passes over the plate above the shoulder or below the knee, then, provided the batter does not strike at it, it is called a *ball*. Four such *balls*, delivered before three *strikes* have been pitched, permit the batter to *take his base*, that is, to proceed to first base without being liable to be put out. Further, if a batsman is struck by a pitched ball, provided he has not struck at it, and the umpire is satisfied that he had made reasonable effort to avoid being hit, the batter is entitled to take his base. Decisions on pitched balls are in every case announced by the umpire, whose authority is supreme in all questions of judgment or opinion. In the most important games there are two umpires, one of whom decides on balls or strikes and the other watches the bases.

FAIR AND FOUL BALLS

Meanwhile, of course, the batsman is at liberty to try to hit any ball he pleases that the pitcher throws. A ball so hit may be called in either of two ways, depending on the direction it takes from the bat. A batted ball that falls and remains on foul ground, or a ground hit that first strikes fair territory and then rolls to foul ground between the home plate and first base or between home and third base, is called a *foul hit*, or, briefly, a *foul*. Similarly, a *fair hit*, or a *fair ball*, is a batted ball that drops on fair ground and remains within it; but if a batted ball is touched by a player on fair ground and is then diverted over the foul line, it is still a fair ball; again, a ball batted to the *outfield* and first falling on fair ground is a fair ball, even though it later rolls into foul territory; a grounder, or a batted ball rolling along the ground, which first strikes foul ground and then rolls into fair territory between home and first base, or home and third base, is a fair ball.

If a batted ball, whether fair or foul, is caught by any fielder before it touches the ground, the batsman is out. Such a batted ball, which rises in the air or travels a considerable distance before touching the ground, is called a *fly*, to distinguish it from a grounder. On a foul ball, even though not caught, the batsman cannot advance to first base. On a fair ball, however, unless it is caught as a fly by a fielder, the batsman is entitled to run to first base and to advance as far around the bases as he can without being touched by the ball in the hand of a fielder when the runner is not himself touching a base with any part of his body. If the base-runner is so touched, he is out. To put a runner out on his way to first base a fielder need not touch him with the ball, but need merely hold the ball securely while with any part of his own body he touches first base before the runner arrives there.

At all the other bases, however, including the home plate, as well as between any two bases, a fielder to put a runner out must touch him with the ball while the runner is off his base, except as mentioned in the next paragraph. If the fielder in attempting to make a put-out in this way drops the ball, the runner is safe.

THE ART OF BASE RUNNING

Let us suppose, then, that our batsman has reached first base safely. He has then completed the first quarter of his journey to the home plate. The other three-quarters still lie before him, filled with dangers for the unwary runner. The man on base must be constantly on the alert, ready to advance on a hit by a team-mate, or a slip or moment of forgetfulness on the part of the opponents. Yet, at the same time, he must remember that they too are watching for a chance to take him unawares away from the base. He must foresee, if possible, the moves of the enemy and refuse to be trapped. Never must a base-runner allow his mind to be distracted from the immediate object of the game; always he must know exactly what player has possession of the ball and be ready to act should that player throw it to catch him.

On a safe hit by a succeeding batsman, the base-runner may advance as many bases as he thinks he can in safety. In fact, when a runner is on first base, or on second with first occupied by another runner, or on third with both first and second occupied, the runner *must* advance when the batter hits a fair ball, to make room for the batter, who on hitting the ball becomes himself a base-runner. Otherwise, since only one runner can occupy a base at a time, the ball need merely be thrown to the next base, which is touched by the fielder receiving the ball, the runner who should have reached that base is thereupon out without having to be touched with the ball. Such a play is called a *force out*. It frequently results in a *double play;* this means a play by which two men are put out at the same time. A double play is completed after a force-out, when the ball is thrown to a base before the batsman has reached there, thus putting him out also.

On a *fly which is caught*, however, a runner must not leave his base until the ball has actually been caught. If he does, he is out if the ball is returned to that base before he can return to it, thus again becoming one of the victims of a double play. Immediately after the catch he may advance if he can. On a long fly-out to the outfield this is very often possible.

The instant the third put-out has been made all attempts at advancing or scoring are, of course, useless. Indeed, after two are out, a run is not scored by a runner crossing the plate on a batted ball, as a result of which the bats-

man or some other base-runner is put out for the third out, even though home may have been reached before the put-out was actually made. A base-runner struck by a batted ball is out.

THE MEANING OF TERMS

The following are additional terms which are used in connection with a baseball game.

A *hit* is usually restricted to a batted ball on which the batter reaches base safely, without profiting by an opponent's misplay or causing the put-out of another base-runner. A hit for one base is called a *base hit* or a *single;* a two-base hit is also known as a *double* or a *two-bagger;* a three-base hit, a *triple* or a *three-bagger;* a hit for all four bases, a *home run*. A *bunt* is a slow hit merely tapped within the infield by the batsman; if a bunt results in a foul, a strike is called. A *time at bat* is recorded each time a player takes up and completes a turn at bat; if he receives a base on balls, or goes to first as a result of having been hit by a pitched ball, or makes a sacrifice hit, he is not charged with a time at bat. A *sacrifice hit* is either a bunt which results in the batsman's being put out, on which a teammate is enabled to advance a base, or a fly-out to the outfield which makes it possible for a base-runner to advance safely after the catch; a sacrifice is, of course, useful only when no one or only one is out. A player's *batting average* is a record of the percentage of safe hits he has made out of his total number of times at bat. A *foul tip* is a strike on which the ball has been merely touched by the bat; it counts as a strike in all cases, but does not in itself count as an out if caught, as would a foul fly.

A *put-out* is, as its name implies, the actual putting-out of a batsman or base-runner by a fielder; thus in the case of a strike-out, the put-out is credited to the catcher, since he handles the ball last in the operation. An *assist* is credited to a player when he, by a fielding play, aids in the put-out by making possible its successful completion by another. An *error* consists in a fielder's misplay in handling the ball, so as to make a probable put-out fail, or so as to enable a runner to gain a base, which, under perfect play, he would not have reached.

A *balk* is a false motion made by the pitcher to deceive a base-runner; it consists usually in making a motion to deliver the ball to the batsman and failing to do so, or in pretending to throw to first base when it is occupied by a runner and failing actually to throw the ball. When a balk is called by the umpire all runners who are on the bases may each advance a base without being put out. A *wild pitch* consists in the pitcher's delivering the ball to the batsman so high or so far out as to be out of reach of the catcher. A *curve* is a ball thrown in such a manner by the pitcher as to change its direction sharply just before reaching the plate. A ball that curves to the left as seen from the pitcher's position is called an *out-curve;* one to the right, an *in-curve*. A *drop* deflects downward; a *raise* ball rises slightly. In throwing these curves the wrist is twisted sharply at the moment the ball is let go, so that the ball has a rapid revolving or spinning motion at the same time that it is traveling in a direct line toward the plate. This spin of the ball creates a cushion of air piled up on one side of the ball, the resulting unequal pressure causing the ball to swerve as its speed of flight lessens. The ball curves in the direction in which its front portion is turning as it revolves during its flight. *Change of pace* consists in varying the speed at which the ball travels from the pitcher's box to the plate.

Many pitchers can curve the ball, but few can put it exactly where they wish to throw it. When a pitcher can do this so well that he can deceive the batter he is said to have good control. This was what made Mathewson such a great pitcher. Other pitchers could throw faster balls than he, and a few could curve them as much, or more, but he had such good control and studied the weaknesses of the batters so well that he won many games.

A FANCY-DRESS TEA-PARTY

ON dull winter afternoons we are often forced to amuse ourselves indoors instead of in the garden and fields. There are many interesting ways of spending a wet afternoon in the house, and perhaps one of the best is to arrange a fancy-dress tea-party.

When we invite our friends we should not let them know what we intend to do, but should tell them as soon as they arrive in the house. If this is done, it will cause much more pleasure and satisfaction all round than if elaborate preparations are made, for the great thing is to spend nothing at all upon the dresses, but to make them up from the everyday materials that are found in the house.

It is really wonderful what striking dresses we can make from curtains and table-covers and similar things.

When we have decided upon a character we must begin to look round for materials to enable us to dress for the part. This is where our skill in dressing-up will come in, for we must not expect to find the exact thing that is suitable.

One of the great pleasures of a fancy-dress tea-party is the search that takes place for the things we require. It is fine fun to ransack the attic, and hunt in various places for cast-off clothing; but we must be very careful not to do any damage or to go where we are forbidden. Moreover, we must ask permission to wear anything that we may want.

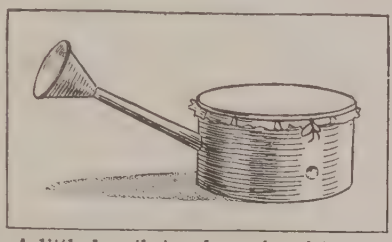
In connection with our fancy-dress tea-party we should offer prizes. This will make the dressing-up much more interesting. The prizes need not be extravagant ones. Boxes of chocolates, inexpensive books of poems, or something similar will do very well. Not only should we offer prizes for the two best dresses, but we should also award a prize for the least skillfully made costume. This should be kept a secret until the voting is all over.

Little slips of paper may be handed round to all the guests, who should be asked to record their votes upon them and drop them into a hat or box. When all have voted we find out whose dress has received the most votes, and award the owner the first prize, the one who receives the second greatest number of votes getting the second prize, and the one who obtains the fewest votes receiving the consolation prize. If any two competitors secure the same number of votes, it is as well to ask all the competitors to vote again.

A BOX THAT DRAWS VOICE PICTURES

IT is possible to draw beautiful designs with the voice, the designs varying in form according to the strength or pitch of the note that is spoken or sung. On page 3554 are given some of the designs that can be drawn in this way; and it is possible to make a simple instrument that will enable us to draw voice pictures of this kind.

We get one of those small tin saucepans that are sold at the hardware shop for about five cents. Then we open the end of the handle, if it is not already open, and also make a hole in the saucepan where the handle joins it, so that the handle is really a tube in the saucepan. The shopkeeper will probably do this for us for a small charge if we ask him. Now we take a piece of thin rubber, such as toy balloons are made of, and tie this tightly over the top of the saucepan, just in the same way as covers are tied on to jam-pots, taking care that the rubber is really well stretched. A piece of a bladder or toy balloon does excellently for this purpose. A paper funnel made like a grocer's sugar-bag, with the edge stuck down, should be inserted in the end of the handle, and our eidophone, a name which means "to copy sound," is complete, so far as its construction is concerned. The picture on this page shows its appearance.



A little box that makes voice pictures.

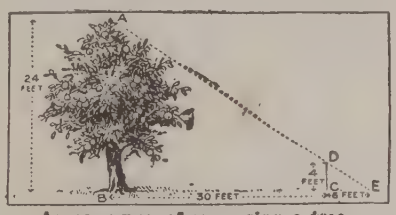
We must be sure that the rubber covering is tied tightly, to get the best result.

We now have to prepare the surface of the rubber covering so that our voice may be able to draw designs upon it. There are various ways of doing this. We may put a very thin layer of colored glycerine over the drum, or we may spread the finest sand evenly on the surface. Then, if we sing a note steadily and continuously down the funnel, the sand or glycerine will gradually take a regular form until some beautiful and delicate geometrical design is produced. By practice, of course, we shall learn to sing the notes continuously at suitable pitches, and according to the change in the note so the design will change. The pictures on page 3554 show how varied these voice pictures may be. Some will come like flowers, others like ferns, and others, again, like trees. The science of voice pictures is explained on page 3558. If we wish to get even more delicately detailed designs than the fine sand produces, we may try lycopodium powder, a fine yellow powder that is the seed of the plants called lycopodiums. This is to be obtained at the drug store, where also we may buy glycerine of various colors. The druggist will color the glycerine for us according to our order. A mixture of colors often gives a result that is startling and of unusual beauty when the voice divides the glycerine into patterns.

In place of the paper funnel inserted in the end of the handle of the saucepan, we can, if we like, get a penny tin funnel, knock the narrow tube off, and have the wide funnel part soldered into the handle. This will make a stronger and more permanent instrument. The whole apparatus will cost at the outside only a few cents, and certainly the results that are to be obtained from it are very striking and astonishing.

MEASURING THE HEIGHT OF A TREE

THERE is a very simple way of measuring the height of a tree which may be in a field or a park, and which it is impossible for us to measure by climbing or in any direct way. Suppose, for instance, that we wish to find out the height of the apple tree, *AB*, in the picture. We first of all go to where the tree is standing and measure a distance of, say, 30 feet from it, in a straight line, marking the spot that is 30 feet from the tree. Then we take a stick, *CD* of any convenient length —a fairly straight branch of a tree will do admirably —and stand this upright in the ground at the spot we have previously marked. Let us suppose that the stick we are using is 4 feet in height. We now walk farther away from the tree in the same straight line as when we measured off the distance of 30 feet. We go from the tree until we come to a point *E* where, with our head on the ground, we see the top of the same stick and the top of the tree in the same straight line—that is, the top of the stick just covers the highest part of the tree. We now have two imaginary triangles, as shown in the picture, and the proportion of the side *CD* to the side *CE*, in the smaller triangle *CDE*, is exactly the same as the proportion of the side *BA* to the side *BE*, in the larger triangle *BAE*. It is clear from this that every schoolboy or schoolgirl can work out the height of the tree. Suppose that the line *CE* is 6 feet. We know that the stick is 4 feet high and the length *BE* 36 feet. From these measurements we have the simple proportion sum 6 is to 4 as 36 is to *BA*. We multiply 36 by 4, making 144, and divide by 6, which gives us 24 feet as the height of the tree. Church steeples, towers and other lofty buildings can, of course, be easily measured by using the same method. The chief advantage which this method of measuring a tree or building has over that described on page 899, is that this can be done in dull as well as in sunshiny weather.



An easy way of measuring a tree.

HOW TO HOUSE SEVERAL BIRDS AT ONCE

DIRECTIONS for making bird-houses have been given on page 341. Now you may learn an easy method of making a larger house for birds from a candy pail and orange crate (see picture 1). Both of these may be secured at little expense from a grocery store where oranges and bulk candy are sold.

As shown in picture 2, the interior of the candy pail is divided into two or four compartments by the use of orange-crate ends, and holes of the proper size are bored for entrances. A ⅞-inch hole should be bored for wrens. For bluebirds the entrance should be made 1½ inches, which can be cut with an expansive bit or a compass-saw.

A removable top, to which the roof is attached, is made from five orange-crate ends. On one end piece you should draw diagonal lines. Using the intersections as a centre, with a radius of 5½ inches, scribe a circle and cut to the line. Place the other four crate ends each with a corner at the centre of the circular piece and nail to that member. Using the same centre as before, with 8¼ inches as the radius, scribe and cut built-up piece into a circle. This circular top, the base for the roof, will now extend 1½ inches all around the upper edge of the pail. Nail the top in place with the small circular piece up.

The nails need not go deeply into the pail, as they are to serve only as locating pins to prevent the top from moving. The assembled roof is held to the main part of the bird-house with four small hooks and screw-eyes, as shown. The centre support for the roof is built up from three pieces of orange-crate-end material ⅝ inch by 1⅞ inches by 8 inches, making a square shaft which, after being pointed, is toe-nailed in the centre of the top. The edge of the top should be beveled at such an angle that a line from a point 8 inches above the centre will pass through the lower edge. The proper angle to point the roof support as well as the bevel on the circular top can readily be determined by a scale drawing. A ½-inch hole bored through the top into each compartment and several holes the same size, ¾-inch from the edge around the rim, will furnish ventilation.

1. Ready for the birds.

2. An inside view.

It is necessary to put a ¾-inch strip of crate-end material from the slant of the pointed shaft to the edge of the circular roof base, so that there will be a firm place beneath the roof for nailing the seam of the roofing material. Its location should be marked on the shingles covering it and also on the body of the bird-house. The roof boards or shingles are cut from the thin stock of orange crates. Four sections or shingles are cut from each piece of material, which averages 5 inches wide.

The layout for the shingles is as follows: Draw a line through the centre of the piece length wise. Measure off 18 inches. Draw a diagonal through each of the 2½ inch by 18-inch rectangles formed, and saw on the lines. Each section of roof is longer than required, but is cut to length after nailing in place, because it is necessary to shift the points at the peak when fitting the sections. For fastening the shingles ⅝-inch No. 20 gauge box nails are used. The length of the shingles will determine the size of the piece of roofing material needed. The shape of the piece can be determined by laying a newspaper over the roof and cutting a pattern. A finished shingle should be about 16 inches long. Overlap each seam not less than ¾ inch. If desired, a metal cone can be made to cap the peak.

If the house is of the hanging type, a pendant may be shaped for the base, or an embroidery or any similar ring can be attached at the centre as a perch for the tenants. If the house is to be placed on a pole a piece about 2 inches by 4 inches by 14 feet should be used, on the centre of the broad sides of which are nailed strips ⅞ inch by 1⅞ inches by 14 feet.

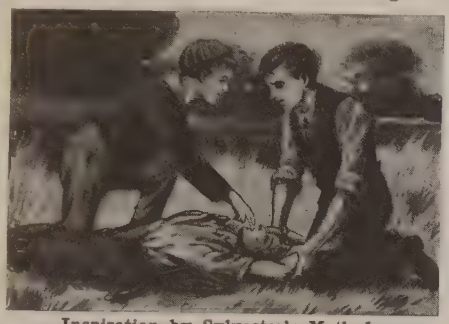
WHAT TO DO IN CASES OF DROWNING

AN EIGHTH LESSON IN FIRST AID TO THE INJURED

CONTINUED FROM 5981

ONE of the most important things for all first-aid students to know thoroughly is how to bring about artificial respiration; that is, how to make a person who has apparently stopped breathing breathe again. Unless we know this we cannot render useful service in cases of drowning, suffocation or gas-poisoning.

There are five different methods of restoring the breathing of an insensible and apparently lifeless person, and they are known by the names of their inventors as Sylvester's, Laborde's, Howard's, Marshall Hall's, and Schäfer's methods. Each is good, and in certain cases has its own advantages, so that we ought certainly to know each of them.



Inspiration by Sylvester's Method.

Sylvester's Method. Place the patient on his back on a flat surface; raise and support the shoulders on a firm cushion or folded garment placed under the shoulder-blades, so that the head will fall well back, as shown in the first picture; remove all tight clothing from the neck and chest; bare the front of the body to the waistline; and cleanse the mouth and nostrils.

Now kneel at the patient's head, grasp the forearms first below the elbows, and draw the arms steadily upward toward you, keeping them stretched out in that position, with the elbows touching the ground for about two seconds. The correct position is shown in the first picture. By this movement air is drawn into the patient's lungs.

Expiration by Sylvester's Method.

Still grasping the arms, push them back firmly upon the chest, pressing them on each side of the breast-bone, as illustrated in the second picture. The effect of this movement is to expel the air from the lungs of the patient. After two seconds repeat the same movements, and keep on doing so, causing the patient alternately to inspire and expire the air, about fifteen times in a minute at least. If there are two persons present to render first aid, while one is restoring breathing in the way described, the other should open the patient's mouth, draw forward the tongue and keep it projecting beyond the lips as far as possible. It is a good thing to flick the chest with a wet towel or else to rub it vigorously with a dry flannel.

Laborde's Method. Sometimes, owing to broken ribs, for instance, Sylvester's Method cannot be followed. In that case Laborde's Method should be tried. The patient is placed on his back or side, the lips and mouth are cleansed, and the tongue is seized and pulled forward as far as possible, being held in that position for two seconds. Then it is released. The operation is repeated about fifteen times every minute, and it will be found advisable to hold the tongue with a pocket handkerchief, as this will prevent it slipping from the fingers. Laborde's Method is generally used in the case of children suffering from suffocation.

Howard's Method. The patient is placed face downward, his chest being supported on a firm cushion or rolled-up garment, and his head resting down on his hand so as to allow the water to run out of the mouth. We then press in upon the patient's back three or four times every few seconds to press the water out of the lungs.

Then, when the water is out, we rapidly turn the patient over with his face upward, the rolled-up garment being placed just below his shoulder-blades. His head hangs down, and his hands are placed above his head. Now we kneel down, with the patient's hips between our knees, and, fixing our elbows against our hips, we seize the lower portion of the patient's chest, and with all our weight and strength press gradually forward for three seconds, until our mouth is almost over the patient's face. Then, with a push, we suddenly jerk ourselves back upon our knees. After a rest of approximately three seconds, we do this over again, and then repeat the movement about ten times a minute, until the patient breathes naturally. In trying to restore respiration we should persevere for at least an hour, as it may take quite as long as that before we see any result, and when natural breathing begins, we should not interrupt the natural breaths, but should continue our movements in between. Howard's Method of artificial respiration can be combined with Sylvester's, the two movements keeping time with one another. Very often we shall have the satisfaction of seeing our efforts meet with success.

Marshall Hall's Method. The patient is placed on the ground, with his face downward and the forehead resting on one of his forearms. After a few seconds he is raised slightly while a folded garment is placed for

support under the chest. To restore breathing we turn the body gently on the side, and then quickly turn it back on the face again, repeating the movement fifteen times in a minute.

Then we turn on the other side, and back on the face in the same way, doing this fifteen times in a minute, and so we go on repeating till breathing is restored. Each time that the body is turned back on the face, we press firmly and evenly, with the hands one each side of the patient's back, between and below the shoulder-blades, stopping the pressure before turning the patient on to his side again.

Two persons are needed for Marshall Hall's Method, as one must attend to the patient's head and arm while he is being turned backward and forward. When he is lying on his face, it is important that his forehead must always rest on his forearm. The explanation of the method is quite simple. When on his chest, the whole weight of the patient's body forces the air out, but when he is turned on his side the pressure is removed, and the air can enter the lungs.

Schäfer's Method. We lay the patient face downward, but it is necessary that the head be turned to one side to leave the nose and mouth perfectly free. No pad is placed under him. Kneeling at one side, in the position shown in the picture on this page, we place the palms of our hands on his lower ribs, with the thumbs nearly touching each other, and then, leaning forward, we press firmly, though not very heavily, straight down upon the back and lower part of the chest. This movement drives out the air, producing expiration. Then, drawing back our body rather rapidly, we relax the pressure without removing our hands, and inspiration is consequently produced. This process we continue for some time, repeating the movements at the rate of about fifteen to the minute.

Schäfer's Method of restoring breathing.

Whichever of the five methods we adopt, we must, of course, continue the various movements described until natural breathing is restored.

In cases of drowning it is best to loosen the clothing, clear the mouth and throat of the patient, and then apply the Marshall Hall Method. As soon as we see that the air-passages are free from water, Sylvester's Method should be used, and if there are two or more skilled helpers it should be combined with Howard's Method, as has already been explained.

While breathing is thus being restored, someone should go for blankets and hot-water bottles, and also for a doctor. When the method used is successful in restoring natural breathing, the patient should be wrapped in dry blankets, and the limbs should be rubbed briskly toward the heart to restore the circulation of the blood. Hot flannels, and hot-water bottles or hot bricks should also be applied to the body.

As soon as the patient can swallow, a little hot tea or coffee or beef-tea should be given, and he should then be put to bed, kept warm, and encouraged to sleep. If there is difficulty in breathing, hot poultices or fomentations or mustard-plasters should be placed on the chest and between the shoulders. The patient should be looked after carefully for a time, and should there be any stoppage of the natural breathing, artificial respiration must be repeated without any delay until the breathing is restored.

Of course it cannot be emphasized too greatly that in cases of apparent drowning the process of restoring breathing by artificial methods must be applied without a moment's delay. Whether the patient be in a boat or on shore, he should simply have such clothes loosened or removed as confine the chest or hamper and interfere with the breathing. Coats and overcoats should, of course, be taken off as rapidly as possible, and if a tight jersey or vest is worn it should be ripped down the front to save time. The process cannot be too speedily applied, as a few moments' delay may make all the difference between life and death.

The method of restoring the breathing is the same for all cases of suffocation. For insensibility from electric shock Laborde's Method is considered the best. In rendering aid to a person who receives an electric shock, we must first be very careful to insulate ourselves before touching the patient. We must stand on some substance that is a bad conductor of electricity —such as rubber, or on a raincoat, dry silk or cloth, dry hay or straw, or dry glass or brick. To insulate our hands before touching the patient we may resort to the use of a rubber tobacco-pouch, or even a dry newspaper. In rescuing a suffocated person from a room full of smoke or gas, we should tie a wet handkerchief tightly over our nose and mouth, and should crawl along, keeping as close to the ground as possible.

If you learn thoroughly these instructions you may some day be of great assistance and perhaps be able to save the life of a fellow-being, perhaps one near and dear to you. There can be no doubt whatever that every year, in hundreds of cases, those given up for dead on account of drowning or suffocation might certainly have been brought back to life and restored to health if only someone present at the time of the accident had possessed the proper knowledge and had treated the cases immediately with the correct method.

While cautioning you about the danger of delay in applying the foregoing artificial-respiration methods, it is not out of place to remind you that the rescuer of the patient must take certain precautions. If a person is in difficulty in the water, perhaps a rope or a lifebuoy thrown to him might be more useful than your assistance in the water if you are not a good swimmer.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 6257.

Tasso.

Boccaccio.

Dante as he appears on his tomb.

Petrarch.

Ariosto.

THE LITERATURE OF ITALY

CONTINUED FROM 5913

THE literature of Italy once had a great influence over all civilized Europe. In England it taught Chaucer, Milton and Spenser much. Yet Italian writers borrowed little in return from Europe. The influence has not yet faded out, but it has not increased, nor has it ever been wholly sustained as time has passed. The reason is that its power comes only from its earliest stages. Italian literature sprang suddenly into a magnificent existence, but it has had no steady renewal. It shines brightly still, but only from afar. It is less an expression of the Italian soul than the literature of the English, French or German. The genius of Italy is expressed in painting, sculpture and music rather than in authorship. Of the nine greatest Italians, Aquinas, Dante, Columbus, Leonardo, Michelangelo, Raphael, Titian, Galileo and Napoleon, only one is a man of letters.

Dante, who gave Italian its stupendous beginning, was contemporary with England's William Langland, who wrote Piers the Plowman. Tasso, who brought Italian to its glorious close, was contemporary with Shakespeare. Since Tasso no Italian writer has held a commanding position in the world of letters and deeply impressed the human mind. There have been periods of positive triviality and periods of serviceable commonplace. That is all. We must look back across three centuries to find Italy great in literature.

The Italian language reached its literary high-water mark with extraordinary rapidity. Its development was delayed by a quite natural devotion to Latin as the language of ancient Rome. Latin long continued as the sole language of the Christian Church, and later as the means of correspondence between nation and nation. All learned men knew it.

The first of the Latin nations to acquire a cultivated literature in the vernacular, or common speech, was the Provençal. The early poets of Provence, minstrels or troubadours perhaps, exerted in their wanderings a great influence on the neighboring countries of Italy and France. Though the first poetry in Italian was produced in Sicily, it was undoubtedly Provençal in character. By degrees the Provençal stanza or verse form was modified, and a lyrical form developed which, in the sonnet, is one of Italy's most precious gifts to literature.

By the middle of the thirteenth century there was considerable poetry in the vernacular in Italy, that is, in one or other of the many dialects into

which Latin had fallen. The poets wrote in the Tuscan or Sicilian dialect, as it might be, because they were generally ignorant of Latin, which in any case would have been wasted upon the lords and ladies for whom they composed their verses.

It was Dante, and Dante alone, who made Tuscan what Shakespeare called "choice Italian," and gave it a literary value that drew all Italy to it, though other Italian dialects remain in common use to this day. Interest in Italian writers before and around Dante is confined to their relation to him. He was very generous in his acknowledgments of his debt to his old friend and master Brunetto Latini, and his admiration of his later contemporary Guido Cavalcanti; but neither of them, nor any of the poets who —like the sweet lyrical singer of the power of love, Cino da Pistoia—were imitating the songs of Provence, can be said to have called forth his genius. Dante stands first and alone as one of the world's supreme poets, mighty in imagination and great in art, who once for all imposed his conception of the Italian language on Italy.

Dante Alighieri was born in May, 1265, at Florence, of good family. His education was such that he absorbed all the learning of his day, literary and scientific. Italy, and particularly Florence, was then divided between the two factions of the Guelphs and the Ghibellines, with frequently recurring civil war. Dante in his youth was a soldier in these wars, and shared the changeful fortunes of the Guelphs. When they became victorious, and the government of Florence was reorganized, he was, at the age of thirty-five, one of six civil officers, known as priors, who governed the city. But the Guelphs broke up into two parties, the Whites and the Blacks. Dante belonged to the Whites, and in 1302, the Blacks having gained power, the poet was exiled from the city and condemned to be burned alive if he should return.

DANTE'S LONG EXILE FROM THE CITY HE LOVED

He never returned, though he often appealed for a reversal of his sentence. Till his death, in 1321, he wandered through the independent cities of Italy, defended by faithful friends. Sometimes he went from city to city on an embassy, and it was while acting in that capacity, between Venice and Ravenna, that he caught the fever from which he died.

Dante, though living in exile for twenty years on account of charges that were palpably false, was known everywhere as a notable man—a scholar, philosopher and statesman, as well as a poet. In an age of violence and prejudice he had far-reaching thought. His ideal was to bring all Italy, and preferably all the world, under one temporal and one spiritual ruler who together might rule all men in peace. The ruler was the emperor, the spiritual leader was the pope. This was his remedy for the wars that cursed the world under many ambitious rulers. But the great union of peoples never came near fulfillment, and it is as a poet that his name is immortal.

Dante stands in history between two great ages. Behind him was the medieval world, with the ancient world of Rome and Greece behind that. Before him was the dawn of the modern world. In his greatest poem, The Divine Comedy, he pictures for all succeeding time the medieval world he knew, but his mind was open to the influences of the freedom that was coming.

THE BEAUTIFUL BEATRICE WHO LIVED IN DANTE'S DREAMS

His first poem had been on the subject which all poets of his time made their chief theme—love. When he was quite a child he admired greatly a girl named Beatrice Portinari, whom he met at the house of her father, Folco. In his own words, "already nine times after my birth the light of heaven had returned, as it were, to the same point, when there appeared to my eyes the glorious lady of my mind, who was by many called Beatrice. Her dress on that day was of a most noble color, a subdued and goodly crimson, girdled and adorned in such sort as best suited with her tender age. At that moment I saw most truly that the spirit of life which hath its dwelling in the secretest chamber of the heart began to tremble so violently that the least pulses of my body shook therewith. . . ."

It is doubtful whether he spoke to Beatrice more than once, but she lived long in his heart as the symbol of woman's beauty and purity. She married someone else and died young. To him she was the ideal woman, and in his work Vita Nuova, or New Life, he told the story of his love for his ideal of womanhood. The book

was written before the chief troubles of the poet's life began.

His Divine Comedy was written—we do not know where or when—during the twenty years of his wandering exile. It is a picture of the future life of man as it was conceived in the Middle Ages.

The poet imagines himself conducted through Hell, through Purgatory and through Paradise. In these places he sees men and women being dealt with hereafter according to the things done by them in the body, whether they were good or evil. Many of the souls kept either in hopeless torture, or under purifying fire, or raised to heavenly places, were people who had been known to him during the changes of his harassed life.

THE STORY OF THE DIVINE COMEDY

Like Spenser's Faerie Queene, the poem is full of hidden meanings, but it may also be read naturally. The poet pictures himself as lost in a forest, symbolizing this world's cares, when he is met by the poet Virgil, who conducts him through the lower regions, where the vicious are punished; then upward through the seven terraces of Purgatory, where suffering is not hopeless; and finally he meets Beatrice, who is his guide through Paradise, where at last he has a momentary veiled vision of God, as his own will is entirely surrendered to the Divine purpose.

The following extracts are taken from the opening cantos of the Inferno. We find the poet lost amid the cares of this world, which are symbolized by a gloomy wood:

In the midway of this our mortal life,
I found me in a gloomy wood, astray,
Gone from the path direct: and e'en to tell,
It were no easy task, how savage wild
That forest, how robust and rough its growth,
Which to remember only, my dismay
Renews, in bitterness not far from death.
Yet, to discourse of what there good befell,
All else will I relate discovered there.

No sooner does he escape by climbing a mountain than he meets with various wild beasts—a panther and a lion and a she-wolf—and turning from them with terror, he discovers Virgil.

While to the lower space with backward step
I fell, my ken discerned the form of one
Whose voice seemed faint through long disuse of speech
When him in that great desert I espied,
"Have mercy on me," cried I out aloud,
"Spirit, or living man! whate'er thou be."
He answered: "Now not man, man once I was,
And born of Lombard parents, Mantuans both
By country, when the power of Julius yet
Was scarcely firm. At Rome my life was passed,
Beneath the mild Augustus, in the time
Of fabled deities and false. A bard
Was I, and made Anchises' upright son
The subject of my song, who came from Troy,
When the flames preyed on Ilium's haughty towers.
But thou, say wherefore to such perils past
Return'st thou? wherefore not this pleasant mount
Ascendest, cause and source of all delight?"
"And art thou then that Virgil, that well-spring
From which such copious floods of eloquence
Have issued?" I with front abashed replied.

Virgil offers to guide him through the lower world,

Where thou shalt hear despairing shrieks, and see
Spirits of old tormented, who invoke
A second death;

and thence to direct him to the terraces of Purgatory and

Those next view, who dwell
Content in fire, for that they hope to come,
Whene'er the time may be, among the blest,
Into whose regions, if thou then desire
To ascend, a spirit worthier than I
Must lead thee, in whose charge, when I depart,
Thou shalt be left.

Dante's Inferno is in shape an inverted cone, divided into seven circles. Each circle contains a different class of sinner who is more wicked and receives worse punishment as the circles get lower and narrower. The guilty are assigned to their punishment by the great hound Minos. He,

Grinning with ghastly feature: he, of all
Who enter, strict examining the crimes,
Gives sentence, and dismisses them beneath,
According as he foldeth him around:
For when before him comes the ill-fated soul,
It all confesses; and that judge severe
Of sins, considering what place in hell
Suits the transgression, with his tail so oft
Himself encircles, as degrees beneath
He dooms it to descend. Before him stand
Always a numerous throng; and in his turn
Each one to judgment passing, speaks, and hears
His fate, thence downward to his dwelling hurled.

We cannot follow the two in their descent, nor Dante's later ascent of the mount of Purgatory and journey through Paradise. You will come to read these for yourselves. There have, of course, been many translations of the Divine Comedy (Dante did not use the first word in his naming of his poem: it was added later). Of these perhaps the best is Cary's. Gustave Doré has illustrated it with some wonderful drawings, which you may perhaps see sometime.

Dante's imagination reaches a majesty unsurpassed. Milton is the only other poet that has dared to attempt a theme so lofty, and with Milton, Shakespeare and Homer, Dante ranks among the world's supreme poets.

THE POET WHO FOUNDED AND PERFECTED MODERN LYRICAL VERSE

"In the year 1304, on the very day when Dante and his exiled companions were making their desperate attempt to fight their way back into Florence, Francesco Petrarca, the child of one of their number, was born in the Tuscan town of Arezza. Six years after Dante's death a casual encounter with a lady who awoke the faculty of song within him made the scholar the first poet of the age." (Garnett's History of Italian Literature.) Petrarch was educated at Carpentras, at Montpellier and at the University of Bologna. His father's wish made him study law, but after the death of his parents he devoted himself entirely to literature. On April 6, 1327, occurred the great event of his life—his vision of Laura in church "at the hour of prime," which made him a poet. His reputation grew rapidly, and his verse made him and Laura famous all over Italy.

For just twenty years he was to have the source of his inspiration where he could find her, but in 1348 a great plague, the Black Death, swept her away in its terribly abundant European harvest. Laura died on the anniversary of her meeting with the poet-lover, April 6. Petrarch remained constant to her memory, and though his life continued active in diplomacy and his interests in literature very broad, his poetry as of old is monopolized by his one passion.

It is for his poetry that Petrarch is justly celebrated. The love sonnets contained in the Canzoniere are in two parts, the first book comprising the pieces before Laura's death, the second those composed after. At the end is the Trionfi, allegorical celebrations, in the medieval manner, of Love, Chastity, Death, Fame, Time and Eternity.

He felt himself ennobled by his love.

Now with such beam and such direction blest
'Twere shameful in brief way to miss the sign
Pointing the passage to eternal rest.
Upward, faint soul, thy heavenward path incline;
Through clouds of her sweet wrath pursue thy quest,
Following the seemly step and ray divine.

When bereft of that love he felt all his purpose gone:

Still have I life, who rail and rage at it,
Lorn of Love's light that solely life endears,
Mastless before the hurricane I flit—
Be this my last of lays to mortal ears;
Dried is the ancient fountain of my wit
And all my music melted into tears.

His younger contemporary, Giovanni Boccaccio, was his friend. Boccaccio speaks of himself as "of Certaldo," a small Tuscan town where he held some property, but he was probably born in Florence in 1313. His father, a Florentine merchant, brought him up to be a trader, but when Giovanni showed great distaste for this, made him study law at the University of Naples. Here the boy sowed his wild oats until he was recalled to Florence by his father, who died in the same pestilence as that which carried off Petrarch's Laura.

Boccaccio was an enthusiastic admirer of Dante and delivered public lectures on him. He rightly believed Dante's Divine Comedy to be supreme in what was then modern literature. He himself may be called the first modern novelist, the "father of Italian prose."

BOCCACCIO'S FAME RESTS ON THE DECAMERON

The Filocopo, his first and longest work of fiction, we should find very tedious to-day, but it is important as marking a stepping-stone from the old metrical romances to the pure novel in prose. For its own day it was an epoch-making work, and it had a great influence on succeeding writers. His Ameto was also important as being the first example of the pastoral romance, and of the weaving of several stories into one whole.

Boccaccio's abiding fame rests on his collection of prose tales, the Decameron. As a framework for this book he imagines the people fleeing from the plague in

6153

© Burton Holmes; from Ewing Galloway.

THE PALMIERI VILLA, IN WHOSE GARDENS THE TALES OF THE DECAMERON WERE TOLD

Florence in the year 1348 and passing the time by telling tales in a garden. The tales, many of them old, are gathered from all kinds of sources, and a number of them offend our taste to-day, but they are told by Boccaccio with fine skill, and they served as a store of fiction for novels and plays for several centuries. The framework of the book, the scene of the story-telling, its groves and orchards, fountains and gardens, charming company, frank converse, are almost more delightful than the stories themselves. In style Boccaccio showed himself the model of later story-tellers, none of whom was ever able to surpass him on his own ground of easy simplicity.

The fifteenth century was singularly barren in Italian literature. There were, besides, no fine statesmen or warriors of real greatness. The age seemed to have lost its intellectual vitality, though in art there was a rapid development of pictorial and plastic work, and a renovation of architecture. The old universities were improved, and private societies of scholars were formed—two achieving special celebrity, the Roman Academy, and the Platonic Academy at Florence, cherished by the Medici. It fell to the latter to decide solemnly that the Italian language was on a par with the Latin, and that no one need lose caste by writing in it.

The Renaissance did not help the Italian language

Nevertheless the classic tongues, Latin and Greek, were absorbing a great part of men's notice. The Renaissance, or Revival of Learning, heralded by Petrarch and Boccaccio, became all-important in the latter part of the century. The Turks captured Constantinople in 1453, and the exiled Greek teachers and men of letters came to the Italian universities with what precious manuscripts they could salvage. Learned Italians caught the fever and began collecting, translating and imitating at a feverish pace. The recent invention of the printing-press spread this knowledge of the literature of ancient Greece and Rome through the length and breadth of the land, and ultimately throughout the whole West. Florence was to the fore in this movement, but other important centres such as Naples, Ferrara, Rome, Mantua, Venice, Bologna and Milan were very active.

But the Latin writing did not help Italian. Count Matteo Boiardo, in his Orlando Innamorato, reproduced the Charlemagne romance which forty years later Ludovico Ariosto continued in his Orlando Furioso with amazing spirit.

In the sixteenth century Torquato Tasso, son of a poet of some distinction, produced in La Gerusalemme Liberata, or Jerusalem Delivered, an epic of the Crusades, the first of Italy's heroic poems. He had previously written, when quite a youth, a graceful romantic poem, Rinaldo, and an exquisite pastoral, Aminta. Tasso unfortunately was too sensitive to criticism: he allowed his detractors to prey on his mind until at intervals he lost his reason; but his poems have retained immense popularity in Italy, and he is in the line of great Italian poets, and brings the line to a close.

Names that stand out in Italian literature

Among Italian writers who were distinguished in prose were some whose fame is not chiefly dependent on their writing: the immortal artist Leonardo da Vinci, who wrote in a masterly way on art; Michelangelo, who wrote on sculpture and architecture, and was an accomplished and powerful poet; Bruno, the martyred scientist; Galileo, the great founder of physics; Tommaso Campanella, the persecuted philosopher whose ideal City of the Sun is still read in English. All were masters of a vigorous prose style.

In the eighteenth century Carlo Goldoni, following on the lines of Molière, introduced forms of comedy which raised the level of the Italian stage, and Vittorio Alfieri brought patriotism, sincerity and tragedy into the national drama.

Alessandro Manzoni, inspired by Scott, achieved a nineteenth-century success with a historical novel; and Giacomo Leopardi won wide admiration as a lyrical poet. As a prose writer the political idealist Mazzini appealed to Europe in an eloquent strain. Gabriele d'Annunzio is a lyrical poet with imagination and power. But his numerous dramas, though interpreted by the greatest actress of the day, Eleonore Duse, in spite of their beautiful dialogue, leave behind a sense of decadence and unnatural horror. But it is true that modern Italian literature has not had the power that carries far. It has lacked the strength of classical restraint, and frittered itself away.

THE NEXT STORY OF LITERATURE IS ON PAGE 6265.

Antwerp Cathedral.

THE GOLDEN YEARS IN EUROPE

CONTINUED FROM 5976

THE growth of Northern Europe during the Gothic centuries—the twelfth to the fifteenth—makes a most interesting story. But if we said, after a summary of the ringing years wherein whole kingdoms changed hands and new ideas rose in men's minds, that "a number of cathedrals were also set up," we should be putting the case wrongly.

France grew up around the feet of her cathedrals like a family about its nurse's knees. Up to the very doorways welled the life of the little townships—tiny houses huddled together in the shadow of the high-flung roofs.

The first group of these great buildings was due to an extraordinary wave of creative energy and zeal that overran northern France in the twelfth and early part of the thirteenth centuries. It lasted for about two generations, and was something like a religious revival whose expression was rather in setting up houses of God than in saving souls. It is difficult for us, a more developed nation, with our growing years almost forgotten, and, moreover—regretfully we must say it—living in an age when useful and money-making things are most important, to understand that fine flowering of the youth of the French nation.

The grand old abbey churches of Romanesque times had been built by monks and belonged to the monasteries. As the various states of France were being drawn into one kingdom, with Paris becoming more and more the centre of government, a new spirit arose and a new power—the power and the spirit of people united in the interests of their towns.

Each town, it seemed, cried out for a cathedral. Some one of the northern architects—no one will ever know at what minute in time's history or in what place in France the door opened on Gothic architecture—someone had somewhere found that the pointed arch could be flung up to any height, and that roofs set on intersecting pointed arches or vaults could soar like clouds above the plain.

This new kind of architecture exactly suited the ardent, adventurous people of young France. The men of a town said: "We must have a cathedral. And we do not mind if some people say that buildings of the new kind will totter and fall. We will take the risk. And our cathedral shall be the loveliest in France."

An architect was summoned, and all

he had to do was to build and to master constructive problems. There was none of that tiresome estimating of costs to be thought of; the people saw to that. Stone in plenty, of a fine quality, was there to be quarried. Those who could not give money gave labor. "Whenever the great blocks of stone were hauled up by cables from the quarry, the people of the district, and even those of the neighboring regions, nobles and commons alike, harnessed themselves to the ropes by arms, breasts and shoulders, and drew the load like beasts of burden."

In such a spirit did these first Gothic cathedrals rise on the barren shore of French towns. A flame of ardor so generous must needs burn itself out. A century after these people prayed among their stones, cathedrals were set up by men who were summoned to work; some of them were built by forced labor.

But in the meantime, while their first cathedrals were building, the townsfolk watched eagerly for such part as might be finished in their own lifetime. Additions were made later—an extended choir here, a chapel, a transept, there. The decorating with sculpture kept hundreds of people eager and happy. But as soon as the bones of the cathedral were put together, so to speak, as soon as the house of God had roofs and walls, doors and an altar, it was opened with joy unspeakable. The townsfolk remembered to their dying day the first time praises were sung under those great echoing arches, which seemed themselves to hold up their pointed hands to pray, to catch the benediction and toss it down again to the crowds, tiny and awestricken, in the nave.

The Story of the Bible in the Windows of Our Cathedrals

To the people, unlettered, superstitious, their cathedrals were more than the centre of town life, their pride and joy, the thing that they had made. They were like huge religious story-books which the most ignorant could read. On the outside of the fabric they could see numberless figures of saints and holy persons, and learn from their attitudes and their emblems something of the reward of goodness. There were also figures of less happy individuals to whom a just punishment had been meted out.

Inside the buildings the lovely golden light of stained glass drew their eyes; and there, rank upon rank, was painted the heavenly company. The whole story of the Bible gleamed out as men passed from window to window.

No peasant ever forgot the Old Testament tales and the Gospel lore learned from the cathedral pictures, and you may be sure that boys and girls growing up in those days were quite clear about the doom that lay in wait for the wicked, and the reward of piety. They were as sure on that point as they were about the number of pinnacles and decorations added to the cathedral since they themselves were three or four. They listened, grouped round the skirts of their elders in the Place, or Cathedral Square, to rare travelers who had come in from one of the highways of Europe and had met with many adventures and had seen great abbeys and churches. But the little ones stared up at their own buildings and felt no other could be so fine.

The Change which came over the Old Church of St. Denis

While in various places in northern France these monuments of the new art were rising, some very memorable work was being done in Paris, both in the precincts of the old Romanesque abbey of St. Denis and in the cathedral of Paris, known all over the world as Notre Dame. In the hands of the builders St. Denis slowly changed from Romanesque to Gothic form. Its Gothic was very simple, as nearly akin to Romanesque as two different styles could be. We are very thankful that the lovely old Romanesque crypt was left, with its pure round arches.

One of the grudges we have against Gothic builders was their inability to let well enough alone. They had wonderful ideals for new buildings; it was a pity they thought that nothing which was not in accord with their new ideals was fit to exist. Therefore they unfeelingly pulled down the Romanesque churches, sometimes to use stone for the new buildings, sometimes because they were weak and needed strengthening, sometimes out of sheer contempt for them. The result is that only here and there can we find the work of some of the earliest Christian builders of Europe. But this scant reverence for the work of yesterday is a human trait which we are constantly meeting to-day.

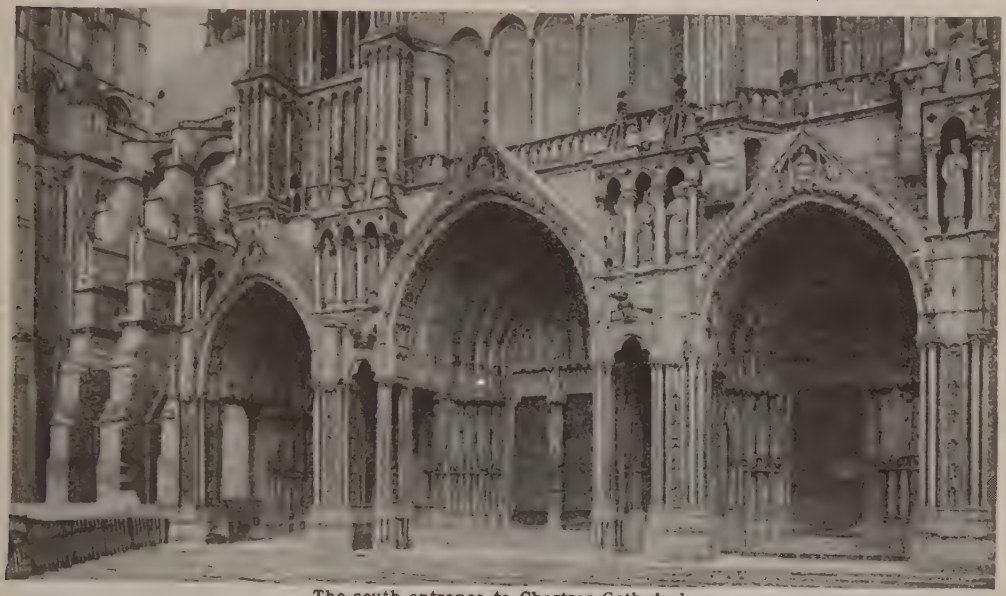
In 1163, very soon after the Gothic choir was consecrated in the abbey church

BEAUTIFUL ARCHITECTURE INDOORS AND OUT

The nave and choir of Antwerp Cathedral.

Details of the front of Siena Cathedral.

The choir and organ in the Great Church, Haarlem.



The south entrance to Chartres Cathedral.

The Gate of the King in Seville Cathedral.

The ambulatory in Chartres Cathedral.

The lovely windows of Sainte Chapelle in Paris.

of St. Denis, the foundation stones of Notre Dame were laid. The building of this cathedral covered about a hundred years. It was begun under Maurice de Sully and shows something of the simplicity of the Gothic work in St. Denis. It is sturdy, like the Romanesque, as if builders had still not forgotten, in spite of themselves, the beliefs of their old faith. They were afraid to fling their arches too high. They set them on enormous pillars, carried them up to the blind-story, rested in solid masonry, then threw up more arches, rested again and finally reached the vault lines.

This early vigor has happily not been lost in succeeding generations, nor at the hands of numerous restorers who worked on Notre Dame in the nineteenth century. The foundation of the cathedral strikes into the roots of a very old Europe. It was built on the site of a heathen shrine which in the fourth century became a Christian altar.

The façade, or chief front of Notre Dame, is one of the noblest productions of early Gothic art. It has the same solidity and clearness of arrangement that marks its interior. Romanesque architects, we know, had derived much of their art from classical buildings; these, in turn, had sprung from Greek architecture, which was so measured and well-proportioned that if one saw only the base of a column one would know the proportions of the whole building.

THE SEVERITY AND SIMPLICITY WHICH GIVE CHARM TO NOTRE DAME

From this rigorous pattern Gothic architecture was destined to take a very wide leap. As we noted in our talk on English Gothic, no two cathedrals are exactly on the same plan or proportion. It happened sometimes that two resembled each other; but, generally speaking, from the end of the first period each Gothic building was a separate adventure.

The façade of Notre Dame is in form nearly a pure letter H. Its severity and simplicity have great charm. We feel very glad that the twin towers which finish off that part of the roof covering the side aisles have never, in the fever of a later period, been decorated or added to. They are just right; the architect who ended the towers in that uncompromising horizontal line had very fine taste. The apse was thrown out, chevet form, a French characteristic we have already noted, with very strong flying buttresses. At a later period the spaces between these buttresses were used for the building of little chapels.

The cathedrals of Lens, Laon, Senlis, Noyon, Soissons, all begun about the middle of the twelfth century, have something of the simplicity of Notre Dame, Paris. They mark that period of early French Gothic which is generally called Lancet, and which ends about the close of the twelfth century. The windows of buildings of this style are pointed, with simple geometric tracery.

The work of the thirteenth century, marked by a development in height and general grandeur, was called Rayonnant. This name was taken from the huge circular windows with wheel-like traceries that marked the cathedrals of the period. In the fourteenth and fifteenth centuries Flamboyant Gothic ran its course in France, characterized by the flame-like, wispy traceries of the windows.

THE WONDERFUL CATHEDRAL AT BEAUVAIS, WHICH IS STILL UNFINISHED

It seemed that when the early twelfth-century cathedrals were in course of construction, architects began to think how much further they could go on the same lines, developing the Gothic idea. They began to have a yearning for tremendous height in the naves and choirs. In some cases, like that of Beauvais, the builders were too daring: their choir just dropped in. The choir was restored, but the cathedral remains unfinished to this day, is but a glorious fragment consisting of a choir and a transept. It has, nevertheless, a very wonderful south doorway, with a great rose window, and the carved doors are a miracle of beauty. They are by Jean le Pot, of Beauvais, and some think they are the finest doors in the world.

The makers of the cathedral of Chartres, begun in 1194 and completed before 1240, succeeded in setting up a very lofty building on more sturdy lines. The nave is an interesting development from that of Notre Dame, but the outside gives an effect of rather rugged strength: there are too many buttresses.

From the façade of the cathedral we can see at a glance that the building was begun in Romanesque times. Curiously, over its round-headed porches is set the wheel window of Rayonnant Gothic. At a later period the Romanesque towers were carried up into Gothic spires. The

north and south porches of Chartres are among the finest pieces of Gothic.

WHY GOTHIC IS CALLED A "RESTLESS" STYLE OF ARCHITECTURE

Bourges Cathedral, remarkable for its heavily sculptured façade with five doorways flanking each other, is a development of another kind. There are no transepts, and thus the building makes a long unbroken line. In Le Mans Cathedral the architect seemed to think more of the chancel than the rest of the church. It has double aisles, and from them open out thirteen chapels; so that inside, the eye can find no rest, no final lines, and outside, the body of the church seems dwarfed behind the monstrous flying buttresses and the projecting chapels.

We need only look at a photograph of the apse of Le Mans Cathedral to see all that Gothic architecture might be and all that it is not. And we can quite understand, if we have not already done so, why it is called a "restless" architecture.

In the nave of Amiens Cathedral, which is one of the loveliest in France, the architect succeeded in realizing his dream of height. It is a very wonderful feat of constructional skill, with scarcely a line to break the soaring pillars and arches. When we look at it we can understand why at one period the ignorant folk of France, terrified at such audacity in the way of building, made up stories about the architects, who, they said, were in league with the Evil One and had sold their souls as a price for their cathedrals' amazing height and slenderly balanced interiors.

THE GENIUS OF THE SCULPTOR IN THE FAÇADE OF RHEIMS CATHEDRAL

The Cathedral of Notre Dame at Rheims, for so long the coronation church of French kings, is one of the most powerful productions of medieval Europe. It has a huge broad nave, where immense crowds could gather on great days. It was planned more or less on the lines of Notre Dame, and its façade somewhat resembles the Paris cathedral. But Rheims grew up, so to speak, in the more florid days of French Gothic, and the simple grandeur of its structure is hidden.

Although each cathedral was different from the others, there was a certain unity in the work of the architects of northern France. Some façades are more gorgeous in adornments than others. The front of Rheims is one great glory of the sculptor's genius in those days, and its pillared, bodiless towers and dainty wheel window give an ethereal look to a very powerful structure. In other façades, notably that of Bourges, the sculpture clings round the great doorways, and the upper part is barer. In several cathedrals a curious look is given to the façade by the towers of different periods and varying form and height that adorn the same building. Rouen Cathedral looks, from the front view, as if all its parts do not belong.

As we noted in our study of English Gothic, the French cathedrals were generally carried so high that they could not support the weight of a tower at the crossing of the nave and transepts, as in the case of the British cathedrals. Sometimes they had a short spire—the highest is the slender shaft of Amiens, added in the early sixteenth century. In some of the churches of Normandy, which were nearest akin to the English, there were central towers, like the one in Rouen Cathedral. For the most part French architects concentrated their interest in towers and spires to the chief front of the cathedral.

THE BEAUTIFUL LITTLE CHURCHES IN THE TOWNS OF FRANCE

The Norman buildings strike a severer note than those in the rest of northern France. At Coutances, Bayeux, Mont St. Michel, on the Brittany border, at Quimper, churches and cathedrals are marked by plainer, more soaring lines. Mont St. Michel is especially famous for its magnificent monastery buildings set within its fortress-like walls. In a great many towns of France smaller churches appeared, some of great beauty. The finest of them all is the Sainte Chapelle of St. Louis in Paris.

In northern France, the cradle of Gothic architecture, the new art grew and expanded, changed its form, was enriched and made complex as the taste of its builders dictated. It had next to no opposition in the way of established architecture. As we go south we see a curious change. The Loire was the northern boundary of the stronghold of Romanesque art, and here pure Gothic has not complete sway. Indeed, faced by that glory, the abbey church at Cluny, one wonders that the people of southern France tolerated Gothic at all.

The cathedrals and churches that were set up south of the Loire were a compound of Gothic and Romanesque. The

most famous are the cathedrals of Albi and Carcassonne. Poitiers Cathedral is an interesting specimen of Gothic-Romanesque; that of Bordeaux shows more Gothic than any other—one of the few cathedrals with flying buttresses in the south of France.

THE UNFINISHED CATHEDRALS WHICH WERE STARTED CENTURIES AGO

Bayonne Cathedral, built in part on the ruins of an earlier structure, and still unfinished, shows some northern Gothic work, and has the remains of a fine thirteenth-century cloister. The cathedral of Toulouse is a strangely-put-together church, and this also is unfinished, though the nave dates from the same period as the Bayonne cloisters. But, however skillfully finished, it can never have the same merit as St. Sernin's, the Romanesque church in the same historic old town, built and finished and its period rounded up before the Gothic cathedral, St. Stephen's, was thought of. Rodez is another wonderful church of the south, its naked-looking walls making a kind of huge pillar support for the sculptured towers of various periods surmounting it.

The farther south one goes, the plainer, more restful is the architecture. The builders disliked flying buttresses and disliked the idea of the nave's being so much higher than the side aisles. They therefore carried the aisles up almost the height of the whole building, and broke their walls with long, slender windows. The roofs were almost flat, and generally beautifully finished with parapets and small pinnacles; there was often a simple tower reminding one of the campanile of the earlier century. The result was a mixture of dignity and severity. Albi Cathedral is called a fortress church.

THE SOMETHING HUMAN AND VERY CHILDLIKE IN FRENCH GENIUS

When the last phase of Gothic architecture appeared, it pleased one of their builders to add to this grand, majestic old church at Albi a most delicate Gothic porch, full of dainty lines and the chasings of the Flamboyant period.

There was always something very human, and a little childlike, in the French Gothic genius. When once its first spiritual ardor was sped, when it no longer flung itself skyward, it wandered about very happily, making beautiful things. And it seemed that no later architect could view the work of an earlier generation without wanting to make his mark on it too.

By its nature it was an elastic art. There could always be another chapel added to a cathedral, another set of pinnacles, or a doorway, with its scope for limitless sculpturing; or the head of a tower could be taken off and its body carried higher, or another tower added.

Before the end of the fifteenth century architects seemed no longer capable of the long "drive" necessary for setting up a big cathedral or church. They were content to work, in unending elaborations, on a piece of one. They were so engrossed in making a porch or a tower look like lacework that a building as a huge scheme became impossible to them.

THE TREASURE-HOUSES OF THE ART OF THREE RICH CENTURIES

This same decorative, rather than constructional, skill had always found scope in the interiors. Long books could be written about French cathedrals without once mentioning structure of walls and roofs and the problems of architecture. They became treasure-houses of the art of three rich centuries. Their little and big images and statues, their tombs, their rood screens, grills, and beautiful doors with wrought hinges, their chancel stalls and bishop's thrones, their altars and side altars—on all these a minute and wonderful skill spent itself.

Gothic art ran its course throughout civilized Europe—in Spain, Italy, Germany, the Netherlands, Austria; it touched Sweden and Hungary; but nowhere had it such a magnificent development as in France and England.

Strassburg, one of the finest of the French cathedrals, was built in the second half of the thirteenth century and added to in later periods. Its erection coincided with the rise of Gothic architecture in Germany. Thus, a hundred very wonderful years had sped after the beginning of Notre Dame before churches in the new style were set up east of the Rhine. Romanesque architecture had a hold there, and Gothic was not welcomed.

For a long time buildings were a mixture of the two styles. Limburg Cathedral and the Liebfrauenkirche, Trèves, are fine specimens of the work that was done in the transition from Romanesque to Gothic. The most interesting church of the two styles is St. Gereon, Cologne, built on an ancient round tomb-house.

THE STYLE THE GERMAN PEOPLE LIKED IN THEIR CHURCHES

The German people kept their love for the many-apsed churches, and they also, in some cases, adopted the French style of the chevet. Like the southern French, they often preferred aisles and nave of the same height, and consequently many of their churches have no clerestory and no blindstory, and are of the type known as the "hall" church. This type of design is very grand internally, owing to the vast height of piers and arches. But the nave is generally not well lighted.

The grand western façades so usual to French Gothic never became a feature of German cathedrals and churches. Their porches are often set north or south and are rarely imposing.

North of Berlin the plain of Europe has no stone, and medieval architects, always availing themselves of the natural material of the district, built here almost entirely in brick. Germany's collection of medieval brick buildings is unequaled.

St. Elizabeth, Warburg, built in the thirteenth century, is an excellent example of the hall church with many apses. The Frauenkirche, Nuremberg, built a century later, is a fine old hall church with a quaint two-storied porch, in which is set the famous clock that starts the figures of the seven Electors in movement about the king when the noon hour strikes. Munich Cathedral is also of this hall type, and many churches, like St. Lambert, Hildesheim, and St. Stephen, Mayence, and St. Stephen, Vienna, with its fine spire.

THE BEAUTIFUL GERMAN CATHEDRAL BUILT IN THE FRENCH GOTHIC STYLE

The cathedrals of Freiburg, Ratisbon and Ulm were all built in the thirteenth and fourteenth centuries and added to later.

Cologne Cathedral is the finest example of French Gothic in Germany, and it is the largest cathedral in Northern Europe. It is imposing, but not great because its proportions are wrong. The French Gothic builders know by instinct how wide a church should be in relation to its length, and just how much weight should go into the transepts and aisles. Here the German architects, building in the French style, were at fault.

They made their double side aisles as wide as the nave, so that the cathedral has far too much width to carry for its length. They also made their twin towers too huge and too high, five hundred feet, so that they overbalance the rest of the building. And in the decoration of the towers their artistry was at fault. They lacked the dainty ingeniousness of the French sculptor.

The secret of the failure of Cologne Cathedral, imposing as it may be, is that it was built by a people to whom Gothic architecture did not really appeal. They obeyed its rules, but knew not its spirit. Their art did not express itself in that way. To them Gothic architecture was a music for which they had no ear.

The technique of their workmanship was excellent. As craftsmen they were hard to beat. They must have carved lovingly their woodwork and stonework, so closely imitative of nature's form. But they lacked the free fling of the Frenchman's chisel.

THE GERMAN FEELING EXPRESSED IN THE CHURCHES OF THE LOW COUNTRIES

The feeling for width that marked the German churches, particularly Cologne Cathedral, was shared in the Low Countries. Antwerp Cathedral, the finest church in Belgium, is very wide, with its seven-aisled nave, which is carried high and has deep windows in the clerestory. A lofty fifteenth-century spire rises from the north end, and at the crossing of the transepts is a curious little turret, reminding one of Saracenic architecture, set up when Spain was the ruling power in Flanders.

Antwerp Cathedral was built in the Flamboyant period and displays the florid taste of the wealthy Flemish burghers. By accident or most wise design, the second western tower was never carried up more than one story; otherwise the cathedral, like that of Cologne, would have been sadly dwarfed.

St. Gudule, Brussels, a much earlier church, has good western towers, in excellent proportion. There is very beautiful stained glass in the choir chapels. It is perhaps in Tournai Cathedral (1066–1338) that one sees most the passage of the architectural periods in the Low Countries, whose changing history and internal rivalries crushed out any great creative spirit like that which has made France wonderful forever.

There is a distinct charm in Belgian architecture, with its spires, belfries, towers and ridged gables. Bruges Cathe-

dral rises very finely over the peace pool of the town. The churches and cathedrals of Ypres, Ghent and Dinant fit happily into their place and show the influence of changing periods. The cathedrals of Holland, Utrecht, Haarlem, Dordrecht are simple, with very bare interiors, but their shapes are made attractive by the level water light flooding the walls and by the immense and tranquil skies of the Dutch landscapes.

The town halls and guildhalls are really the most characteristic Flemish buildings. Of these the Cloth Hall at Ypres (1304) is the earliest and most imposing. Similar halls were built not much later at Bruges, Louvain, Malines and Ghent. The town halls were mostly of later date, the earliest being that of Brussels (1377), then Louvain (1448–63) and Oudenarde in the early sixteenth century.

Pure Gothic Architecture Rare in Italy

In certain parts of Italy pure Gothic architecture never appeared. The Gothic spirit was part of the miracle of the Italian Renaissance, as we remember in our earlier chapters on painting and sculpture, but its expression was altered by existing forms and traditions. Rome, the stronghold of classic art, closed her doors against this northern invader; there is only one Gothic church, Santa Maria sopra Minerva, in the whole great area of the eternal city.

Elsewhere in Italy the resistance of Romanesque and Byzantine traditions was great. The high-flung vaults of northern France were not suffered to rise; there were few flying buttresses and pinnacles; roofs were kept flat, windows small. The main feature of French Gothic had been upward-soaring lines; the Italian architects insisted on horizontal ones. The result is a most interesting group of buildings, but they can hardly be called Gothic.

The nearest in spirit to the buildings of the north, and the exception to several of the rules of Italian Gothic, is Milan Cathedral, and it is more German than French in plan. This great marble pile, which took a hundred years to build and absorbed the energies of half a hundred architects, is one of the most wonderful creations of a wonderful period.

It is the second largest cathedral set up in medieval times. But the merit of the building is something not measurable by square feet; nor is it flawless in style and proportion. Its numberless pinnacles and points, surmounted by statues, seem as if they were stalagmites flung upward from a fairy grotto. The long, horizontal lines of the building are broken only by long, narrow windows and unobtrusive buttresses, the whole formation delicately hung in a web of vertical strands. Huge as a fortress, it seems as delicate as a lace shawl.

The Duomo at Florence, also called Santa Maria del Fiore, is a building of a very different kind. It was erected in the Gothic period, from about the end of the thirteenth century to the middle of the fifteenth, but in spirit it is Italian Romanesque. It is a remarkable structure, in plan a long cross of an unusual type. The nave leads up to a great domed octagonal space, and from this three apses, each domed, break out, one in the eastern end in the usual way, and twin apses in place of transepts. Five chapels cluster round each apse.

To pass from the nave into this great area of radiating shapes is to receive an unforgettable impression of majesty and dignity. A quaint clerestory of circular lights is set high in the nave walls. The general effect of the exterior, with its colored marble panels and small windows, is horizontal—long lines following each other round the entire building, and all leading on to receive the weight and insistence of the massive dome. The decorating of the west front was begun in the thirteenth century and left untouched till late in the nineteenth.

Round this cathedral much ambition and pride and many lives have gathered. We know something of the immense pride of the Florentines in their city and their art from our earlier chapters, and the cathedral, with its campanile and the baptistery standing close by, is the large monument of their heroic spirit. Famous names run in and out of its story. The first architect was Arnolfi di Cambio. Some time after his death Andrea Pisano and Francesco Talenti took up the work. The crowning labor, in more ways than one, was the huge dome set up by Brunelleschi when Renaissance architecture was developing in Italy.

The baptistery is a Romanesque building to which Arnolfi di Cambio made alterations in the late thirteenth century. It is octagonal in shape and faced out-

wardly with black and white marble. This building is famous for its marvelous bronze doors, the work of Ghiberti and Andrea Pisano, of which you can see a picture on page 1741.

The campanile was designed by Giotto, a truly Italian structure of great beauty. As in the case of most Italian towers, like those at Siena, Mantua, Lucca and Verona, the contour is unspoiled by buttress projections; the slender shaft rises cleanly from the ground, its walls a lovely pattern of colored marble panels and sculptured reliefs. This tower, contrasting with the horizontal lines of the cathedral, and balancing the heavy mass of the dome, finishes one of the finest groups of medieval architecture in Europe.

In addition to the cathedral, Florence possesses some very fine churches—Santa Croce, planned by Arnolfi di Cambio; Santa Maria Novella, whose architects were two Dominican monks; and Or San Michele, planned by Taddeo Gaddi. Or San Michele possesses some particularly lovely statuary by some of her famous sculptors, like Donatello and Ghiberti. In Santa Croce are sculptured tombs to many notable persons.

When we think of Italian churches we think first and foremost of the historic San Francesco at Assisi, set up in the middle of the thirteenth century. It is built on a hillside in two stories. The style is simple: there are no aisles, and both the upper and lower church end in an angular apse. It is not only a most interesting architectural work, but a monument to a man whose story is eternally bound up in the early years of the Italian Renaissance. We know, from our chapters on painting, of the frescoes that adorn the dim, vaulted interiors of the upper and lower church.

The interior of the Church of Santa Maria Sopra Minerva in Rome.

The cathedral at Siena, set up as a kind of stepped platform on the sloping ground, is a fine and imposing building, marked, like most of the Italian Gothic

cathedrals, with a dome over the wide space at the crossing. All the artists of the town helped to set up and adorn this their chief church, and their pride in it was immense. It was planned on a huge, ambitious scale. The actual building took from 1245 to 1380, but the proposed second nave, a continuation of a transept, has never been finished. On floor and walls, outside and inside, the art of Siena has stamped her cathedral. One of its most renowned features is the pulpit carved by Niccola Pisano.

In the cathedrals of Orvieto and Palermo, and in churches like San Antonio, Padua, San Giovanni and Santa Maria Gloriosa, Venice, Sant' Anastasia, Verona, and San Petronio, Bologna, the art of Gothic years in Italy produced wonderful and memorable work. The farther south we go, the more remote from pure Gothic is the style. The metropolitan church at Palermo is built on the plan of the old basilican churches, and reminds us more of Saracenic architecture than Gothic. In almost every Italian church there are sculpture and adornment by great artists. Some churches were built by monks out of love of God; some by citizens out of pride in their city.

The Influence of the Moors in the Buildings of Spain

We spoke just now of Milan Cathedral as the second largest in medieval Europe. The first in point of size is the cathedral of Seville, which, except for St. Peter's, Rome, is the largest church in the world; and this brings us into that strange and attractive world of Spanish art, where the genius of the so-called Moors has left an ineradicable strain of beauty. Some of the most delightful work of Europe hides in odd corners of Spain: doorways which make one think, curiously, of some haunting song that is native to no one country or period; walls that strike a dreaming silence, as if the world had forgotten to pass that way.

In the north of the peninsula, naturally, in Catalonia, the influence of Gothic was most felt. But pure French Gothic is almost unknown. The architects threw up great vaulted buildings, and nestled little chapels between the buttresses, so that the walls seem flat outside. Horizontal rather than vertical lines mark the structures. Windows are not huge, as in the north of Europe; cloisters of great beauty, as at Barcelona, Segovia, Toledo and Lerida, are ornamented in a style natural to the inheritors of Saracenic art. The style of the horseshoe arch, the endless geometric wall-decoration, and the open stonework of Moorish times passed on through the short Romanesque period—whereof few traces remain—and allied itself naturally with Gothic, making a different architecture from the rest of Europe.

Seville Cathedral was built in the fifteenth and early sixteenth centuries on the site of a Mohammedan mosque. Its great masses are grouped unfamiliarly, but the structure nevertheless achieves a distinction not given by hugeness alone. Its lovely stained glass throws shafts of color across the great aisles, each as wide as the nave of Westminster Abbey, and makes even richer the rare carvings and ornamentations. In a smaller place the adornments would be too heavy, but the cathedral is proportioned very happily. Were the exterior as graceless as a barn, it would still be saved by the Giralda, one of the loveliest towers in the world, of which we have already spoken.

All the medieval cathedrals and churches of Spain are intensely interesting. One feels continually that history no less than the architect has been planning and shaping here. Of no one building could it be said that it is purely such and such a style. The cathedrals of Valencia and Leon, set up in the thirteenth century, remind one suddenly of France; Barcelona is a little Italian in shape. Toledo, Avila and Gerona are marked by rich interior carvings.

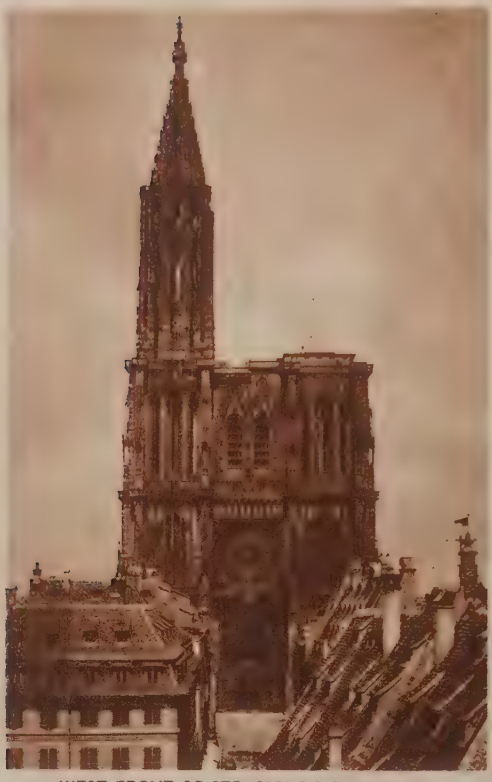
Burgos, begun between 1220 and 1230, is perhaps the most romantic and Spanish of all the cathedrals in the peninsula. One of the loveliest doorways in Europe is that of San Pablo, Valladolid. It might be classed as Gothic, but the long-dead Saracens guided the builders' hands.

Spain was too conservative, for all her upheavals, to allow herself the fine, undivided enthusiasm of early France. As we think of her sacred buildings we wish perhaps that she had expressed herself singly and loudly in some one great way, as the Gothic architects expressed themselves in France. Then when we look at her work again and see, here the Saracen, here the Romanesque, here the Gothic, and everywhere the sense of Spanish art, we would not have her changed at all.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6297.

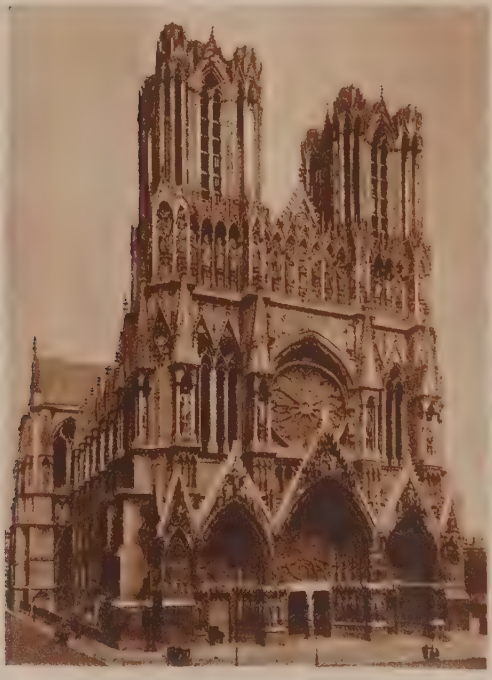
BUILDINGS OF EUROPE'S GOLDEN AGE

THE WEST FRONT OF THE BEAUTIFUL CATHEDRAL AT ROUEN



WEST FRONT OF STRASSBURG CATHEDRAL

THE HALLES WITH THE FAMOUS BELFRY AT BRUGES



RHEIMS CATHEDRAL BEFORE THE WORLD WAR

BURGOS CATHEDRAL, IN SPAIN

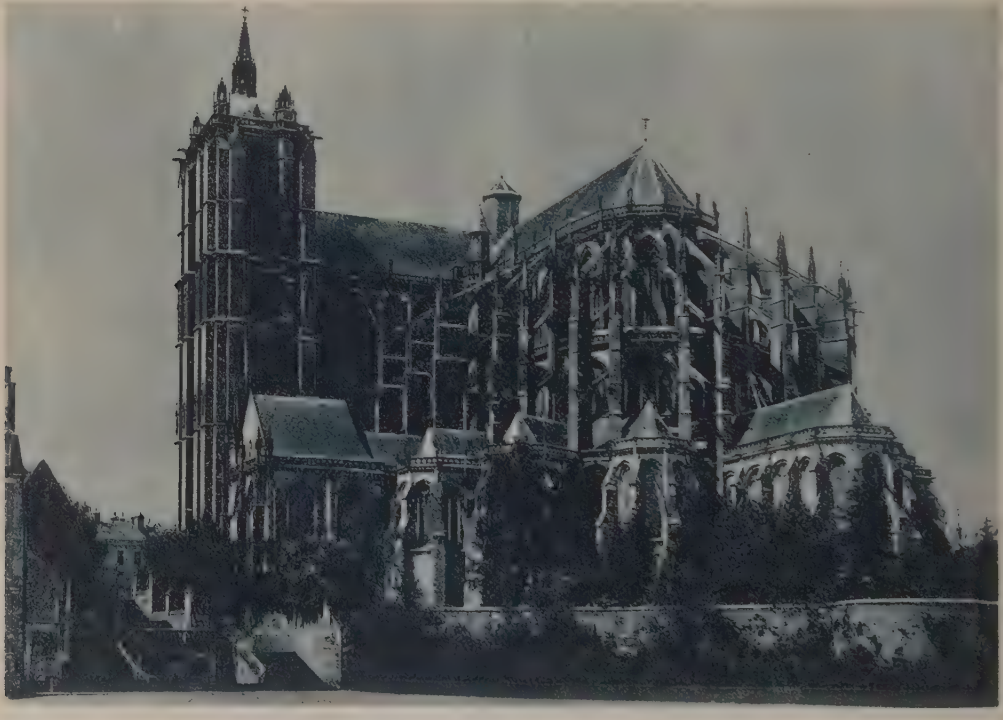
THE CATHEDRAL OF NOTRE DAME IN ANTWERP

ULM CATHEDRAL, IN GERMANY

NOTRE DAME AT LAON

AMIENS CATHEDRAL

THE BEAUTIFUL CATHEDRAL OF NOTRE DAME IN PARIS, SHOWING THE APSE



THE APSE OF THE CATHEDRAL OF ST. JULIEN AT LE MANS

THE NORTH SIDE AND WEST FRONT OF CHARTRES CATHEDRAL

THE FRONT OF THE WONDERFUL CATHEDRAL OF MILAN

COLOGNE CATHEDRAL

SIENA CATHEDRAL

THE SAINTE CHAPELLE IN PARIS

RATISBON CATHEDRAL, IN GERMANY

THE CHURCH OF SAN FRANCESCO AT ASSISI

THE CHURCH OF SAN ANTONIO AT PADUA

THE HOTEL DE VILLE AT COURTRAI

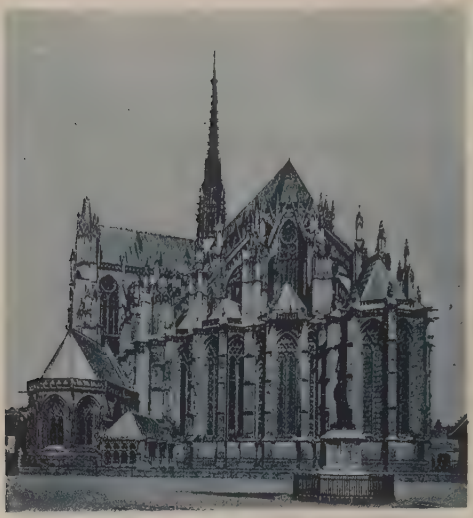
THE OLD CATHEDRAL AT CARCASSONNE

ST. STEPHEN'S CATHEDRAL IN VIENNA

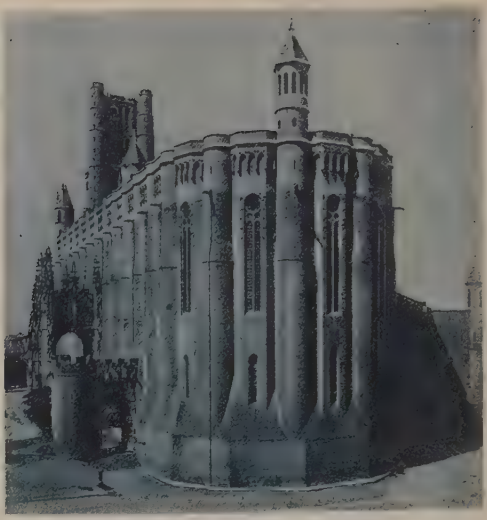
BURGOS CATHEDRAL, SHOWING THE LANTERN

NOYON CATHEDRAL BEFORE THE WORLD WAR

SENLIS CATHEDRAL, IN FRANCE

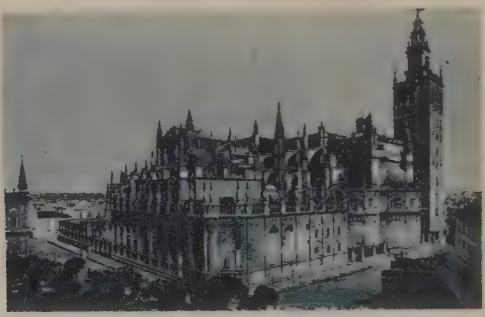


THE APSE OF AMIENS CATHEDRAL

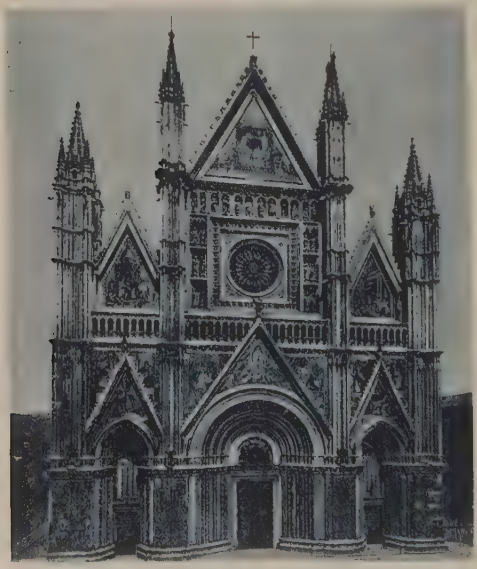


ALBI CATHEDRAL, IN FRANCE

THE GREAT CHURCH AT HAARLEM, IN HOLLAND



THE CATHEDRAL AT SEVILLE



ORVIETO CATHEDRAL, IN ITALY

NOYON CATHEDRAL BEFORE THE WORLD WAR

The pictures on these pages are reproduced by courtesy of Messrs. Alinari, Anderson, E.N.A., Neurdein, York & Son, and others.

Photo, Northwestern Photographic Studios, Inc.
Twin moose babies.

WHY CAN BABY ANIMALS WALK SO SOON?

CONTINUED FROM 5962

A GREAT book might be written about this wonderful question. One of the answers to it is that there is to some extent a proportion between a creature's length of life and the length of time it takes to grow up. We should expect the growing-up process to be quicker in the case of an animal that is very old at fifteen than in the case of a creature that may live to be a hundred or more years.

But this fact does not nearly account for the extraordinary difference in the rate of development of babies as compared with the lower animals. There must be some other principle at work. Part of the explanation is that in the highest types of animals we find that the young creatures are much more dependent upon their mothers, and for a much longer time, than are the lower animals. This is true if we compare the lives of birds with those of reptiles, or horses or dogs with fishes, or even with rats and rabbits. It is far more true when we compare ourselves with the lower animals.

Now, at first it seems surprising that the highest kinds of creature should be less capable when they are born than lower kinds. But if we compare man with, say, a dog, we shall see the reason. A dog, because it is much higher than a rabbit or a fish, can learn a little; but most of what it does it does by instinct, and instinct requires no teaching. A man has instincts, too, but the great mark of him is that he is intelligent; and though intelligence can learn everything, it has everything to learn. The baby is born knowing nothing, but with endless powers of learning, and that is why it takes so long to do things.

WHY DO WE WORRY?

Worry is a state of feeling, and, as everyone knows, it may be aroused by many causes, real or imaginary. Yet this is a question well worth answering, because it helps to teach us a great fact about ourselves. If we think about worry and observe ourselves, we shall notice that we do not worry about the present. We worry about having to go to the dentist, but when the tooth is

actually being drilled we do not worry, though we may fear. Worry is perhaps fear, but it is always about either the future or the consequences of the past—usually the future.

A creature, then, that lives entirely in the present cannot worry; but all creatures except ourselves live in the present, and babies and very small children live in the present, too, so they cannot worry. The great and grand mark of man, however, is that, as Shakespeare said, he is "made with such large discourse, looking before and after." It is this power of "looking before and after" that makes worry possible. Therefore, just as worry cannot happen in cabbages or animals, or even in infants or two-year-olds, so it is *most* liable to happen in the highest types of human being, who invariably have most imagination and live least in the present and most in the future.

This power of mankind by which we are aware of ourselves, and can figure ourselves in the past and in the future, is called self-consciousness, and is, above all things, that which distinguishes us from all other creatures in the world. And worry, as we have seen, is one of its consequences.

WHAT IS A THERMOS BOTTLE?

A thermos is a bottle that keeps a hot liquid hot for a very long time. *Thermos* is simply the Greek word for "heat"; but it is really not a particularly good name, because, though it keeps a hot liquid hot for a long time, it also keeps a cold liquid cold. That fact really gives us the key to what happens, if we have right ideas as to what heat is. Heat is something, and cold is only the absence of heat. Therefore, when this little instrument keeps a hot thing hot, it must, somehow or other, be keeping the heat in, and when it keeps a cold thing cold, it must somehow be keeping heat out.

Now, we know perfectly well that a flannel blanket, for instance, acts in just the same way. It will keep a hot thing hot because it keeps its heat in, and it will prevent ice from melting because it keeps heat out. It does these things because it is a bad conductor of heat.

A thermos bottle, then, must somehow be a bad conductor of heat. Between the outer and inner walls there is a space which is full, as far as possible, with simply nothing. If there were air there, in the usual quantity, it would readily conduct the heat from inner wall to outer wall, or in the opposite direction, but the bottle is so made that there shall be as little air in this space as possible, and so there is very little to carry heat across. A blanket is more like a great gate through which the heat cannot go in or out, but the thermos bottle is more like a moat or ditch over which the heat cannot jump in or out.

IS A STONE ALIVE?

The answer to this tremendous question depends on what we mean by alive. Animals and plants do certain things that no stones or rocks do. Stones take curious and regular forms, as in crystals and in the columns of the Giant's Causeway in Ireland, shown in the picture on page 2931. Crystals grow, and sometimes it looks as if little crystals grew from them; but they do not breathe, and they have not certain other powers which even the simplest and humblest of living things possess. So we must say that, in the strictest sense of the word, stones are not alive.

But that is very far indeed from being the whole answer to the question. It is a proved fact that the substance of which stones are made can help to build up the bodies of living creatures, and these bodies can be broken down into simpler chemicals and made into stones. This seems very curious, but it is true.

Silicon is the name of the commonest element in rocks and stones and sand and clay, and we find that it helps to form the living body, as in the case of wheat, the straw of which always contains some amount of silicon.

WHY DOES MILK TURN SOUR?

The change that takes place in milk when it turns sour is due entirely to the growth of microbes in it. If the milk is boiled, and then sealed up in something, it will not turn sour in any weather or in any length of time, because all the microbes in the milk, including those that turn it sour, have been killed by the boiling. Much warmth and electricity in the air to which milk is exposed favor the growth of the microbes in the milk. Microbes are plants, and we know that warmth and electricity in the air favor the growth of other plants, such as wheat or potatoes.

The stuff in sour milk which gives it its sour taste is an acid, of course, and it has the special name, which everyone should certainly know, of *lactic acid*, which simply means "milk acid." It is made by microbes from the sugar in the milk, which has the corresponding name of *lactose*. Lactic acid is not bad for us, but good for us; and if good, clean milk turns sour, it is none the worse for that, but in some ways, and for some people, it is much better than is milk as we usually drink it.

WHY DOES A BIRD FORSAKE ITS NEST IF ITS EGGS ARE TOUCHED?

The whole meaning and purpose of the bird's nest is to be found in the eggs. The eggs exist for the future of the bird race, and the nest exists for the sake of the eggs. If the eggs are stolen, then the instinct which made the bird build the nest is disappointed, and we cannot be surprised that the bird deserts her nest.

But sometimes it may be that, even though some or all of the eggs are left, the bird may forsake her nest if it has been touched. In such cases we can only guess what really happens.

It may quite possibly be that, when the eggs have been handled, the bird is aware of a strange scent in the nest, and this "puts her off," as we say. She feels that something is wrong, and she loses heart and goes away. But such a question could only be answered for certain by making many careful experiments, which would not be kind.

WHY DO WE SLEEP?

No one is quite sure why we go to sleep, but we think the real reason is that, while we are awake, we make something in our bodies which the blood carries to the brain which puts it to sleep, just as medicine will put you to sleep. The best kind of medicine is the kind that is most like the stuff that we make in our bodies for this purpose. We go to sleep so as to rest. The whole body rests when asleep, more or less—the brain, the heart, the lungs, the muscles, stomach and all. Children need a lot of sleep because they have to grow, and they do most of their growing during sleep; so if they will not go to bed they will not grow properly. Sleep is more important for children than for anyone else, just for this reason, though no one can get on without it. Many of the people who grow up too small or weak, or poor in their minds, are people who did not sleep enough when they were children.

WHAT IS VERDIGRIS?

Verdigris is the rather curious name of a particular salt or compound of the element called copper. It is a compound made of copper and the acid called acetic acid, which is the acid that gives its taste to vinegar. So, in the language of chemists, verdigris is copper acetate. Copper is, under certain conditions, a poisonous metal, and so many people are very much afraid of verdigris when they see a film of it on copper faucets, for they think they might be poisoned through drinking the water that comes from them. But verdigris is not so poisonous as that, though faucets should be kept clean. It has a very brilliant green color, as we might guess if we look at the first four letters of its name, which are the French for "green," and which we see in such words as *verdure* and *verdant*.

IF WE COULD GO ON TRAVELING UPWARD, WHERE SHOULD WE END?

The word "upward" has no real meaning. The earth is a round ball. Upward simply means "away from the ball," and we might therefore make a continuous upward journey from any point of the earth's surface, and the result would be different in every case. The upward journey from any point would, for instance, be in directly the opposite direction to the upward journey from another point exactly on the other side of the earth. For every point on the earth's surface plainly must have a point exactly opposite it, and the point opposite any other is called its *antipodes*, a word which means "opposite the feet."

But suppose we make our question more manageable by thinking of only one point, anywhere on the earth's surface, and then asking what would be the end of a continuous upward journey from that point. Then time comes into the question, for the line of the journey would never be the same in any two seconds of time, in consequence of the various motions of the earth. But suppose we fix on a place and on a moment of time, the answer, whatever the place and the moment, will be the same—that such a journey would have no end, for we cannot imagine that space has any end at all.

IS IT GOOD TO HAVE TO WORK?

Work is a thing we all tire of at times, and we all enjoy the hour when we can stop working. We look forward to our vacation; we don't like having to get up in the morning; and we wish someone would leave us a fortune. Yet, if we have any sense at all, we know in our hearts that our work is good for us, and we see every day around us the consequences that follow when people, even those who have plenty of money to amuse themselves, have no work to do.

There are two classes of people with money—those who find some work for themselves, in spite of their money, and those who do not. The first are probably happier for their money; it need do them no harm, and may do them much good. But those who find no work to do are always the worse for their money. Human beings must have occupation and a purpose in life or their lives are worth less than nothing, both to themselves and to other people.

WHY IS FOAM WHITE?

Foam is made, not of crystals of solid water, but of bubbles of liquid water, and the tiny bubbles do just what the crystals do. Between them they throw so much light back from their surfaces—just as a single soap-bubble does—that they make the foam look white. Here, of course, the same thing is true—that the foam is white only when it is seen by a white light, such as sunlight. If the light of the sun were green, then foam would be green, and snow too.

The startlingly clear white that foam has on a bright sunny day is possessed by a flower found growing among rocks. So, it is called the "foam flower."

WHY DOES SUGAR DISSOLVE MORE QUICKLY IN HOT WATER THAN IN COLD?

This sounds a very simple sort of question which anyone ought to be able to answer, but, in point of fact, it is extremely difficult, and no one can answer it. We can only study the facts and hope that those who come after us will be able to add to them from the greater knowledge that they have gained, and find out the answer at last. The main fact, we know, is that what is true of sugar is true of almost everything. If it were true of everything, the case would be simpler, but there are a few things which will dissolve in cold water and not in hot water. These very curious exceptions make it all the more difficult for us to answer this question.

We can see how difficult such a question as this must be when we ask ourselves what really happens when anything dissolves, or melts. If we could answer that, no doubt we could explain how different conditions affect the melting.

But how can we expect to do so while we cannot yet answer the first question—what happens when sugar melts? We know that the sugar disappears; we know that it is not gone, for we can get it back, and the water containing it is heavier by just the weight of the sugar that is melted in it. But what state the sugar is really in when it has melted we cannot say.

When water is hot it takes up more room than when it is cold, and we must suppose that there is more room between the molecules of it. This should mean that there is more room to hold the molecules of sugar.

WHAT MAKES US SNEEZE?

Usually we sneeze because there is something in our nose that should not be there. The nose is the proper channel for the air we live by, and our brain is made so that when anything interferes with this channel it makes us breathe out violently through the nose, and that is a sneeze. The inside of the nose must be ready to feel the least thing so as to tell the brain what is wanted. Of course, it is not we ourselves who do this, but the unthinking part of our brain; and as it cannot always tell whether sneezing is needed or not, it often makes us sneeze when the blast of air through the nose has nothing to clear away and the only trouble is a little irritation. We sneeze at pepper because it irritates the inside of the nose. One kind of sneezing is due to something in the way the nerves of the brain are connected, and is not a bit of use, and that is sneezing at a bright light, usually the sun. To blink at the sun is sensible, for that protects the eyes, but there is no sense in sneezing at it. You can almost always stop a sneeze when you feel it coming, by pressing on the nose, especially on each side, about halfway down, just where the bone stops. There is a little nerve here which, when it is pressed, tells the brain to go no farther.

WHY IS BOSTON CALLED "THE HUB OF THE UNIVERSE"?

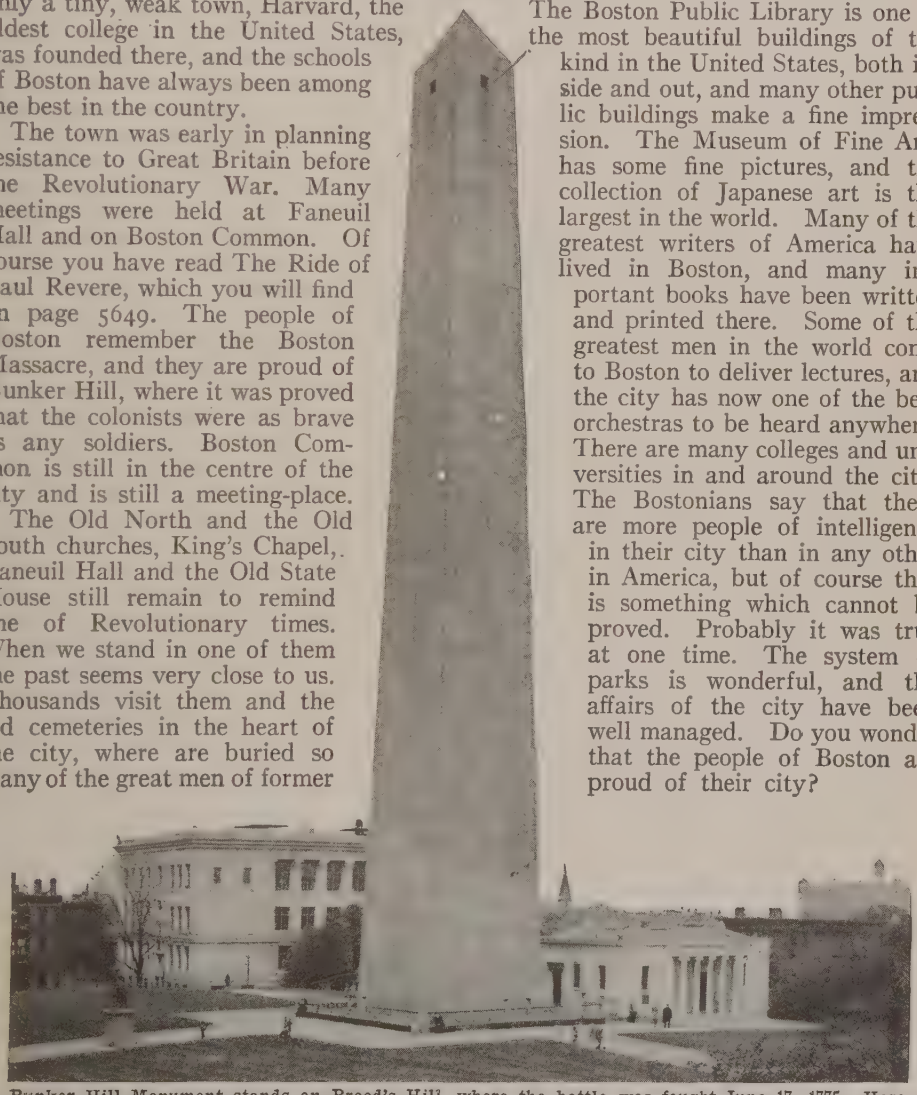
Oliver Wendell Holmes was himself a Bostonian, but in one of his books he poked good-natured fun at those people who think that Boston is the most important city in the world. He said that the Bostonians thought that the dome of the State House was the centre of the earth, and that Boston must therefore be the hub. Laying joking aside, the Bostonians have good reason to be proud of their city. It has always been a leader in great movements. When it was only a tiny, weak town, Harvard, the oldest college in the United States, was founded there, and the schools of Boston have always been among the best in the country.

The town was early in planning resistance to Great Britain before the Revolutionary War. Many meetings were held at Faneuil Hall and on Boston Common. Of course you have read The Ride of Paul Revere, which you will find on page 5649. The people of Boston remember the Boston Massacre, and they are proud of Bunker Hill, where it was proved that the colonists were as brave as any soldiers. Boston Common is still in the centre of the city and is still a meeting-place.

The Old North and the Old South churches, King's Chapel, Faneuil Hall and the Old State House still remain to remind one of Revolutionary times. When we stand in one of them the past seems very close to us. Thousands visit them and the old cemeteries in the heart of the city, where are buried so many of the great men of former days. The Winthrops lie in King's Chapel Burying Ground, which was the first cemetery laid out, and in the Granary Burying Ground are the graves of Samuel Adams, James Otis, Paul Revere, and many others of whom you have read.

Boston is proud of her later history, too. During the Civil War the city was always strong for the Union and has many monuments of that stirring time. Some of the best statuary in the country is in Boston. The State House, on Beacon Hill, was designed by Charles Bulfinch, and its gilded dome can be seen from afar.

The Boston Public Library is one of the most beautiful buildings of the kind in the United States, both inside and out, and many other public buildings make a fine impression. The Museum of Fine Arts has some fine pictures, and the collection of Japanese art is the largest in the world. Many of the greatest writers of America have lived in Boston, and many important books have been written and printed there. Some of the greatest men in the world come to Boston to deliver lectures, and the city has now one of the best orchestras to be heard anywhere. There are many colleges and universities in and around the city. The Bostonians say that there are more people of intelligence in their city than in any other in America, but of course that is something which cannot be proved. Probably it was true at one time. The system of parks is wonderful, and the affairs of the city have been well managed. Do you wonder that the people of Boston are proud of their city?



Bunker Hill Monument stands on Breed's Hill, where the battle was fought June 17, 1775. Here the untrained Americans resisted the British soldiers until their powder was gone. The monument is 221 feet high, and has a stairway to the top inside. It was begun in 1825 and dedicated in 1843. Daniel Webster spoke at both celebrations.

DO A HORSE'S EYES MAGNIFY?

It is sometimes said that the reason why a horse obeys a man who is smaller than itself is that the horse's eyes magnify, so that it gets an impression of size which causes it to obey. This is not an idea that anyone should really believe.

To begin with, if a horse's eyes magnified, everything would be magnified, and a man would still be small in proportion to, say, another horse. Again, like ourselves, a horse is not dependent merely upon its sight to know size; it knows by feeling and sound that a man is smaller than itself.

But, of course, a horse's eyes do not magnify at all, quite apart from the fact that the horse would not be deceived if they did. To magnify is to make a thing appear larger than it really is. An eye made like a magnifying glass might do this when looking at a very near object, and it is probable that there are eyes in certain tiny animals which are really "microscopic," as we say.

But no eye can possibly magnify anything seen at a distance, for even the telescope cannot do that. It can only make the image of anything seen less small than it would appear without the telescope. A horse's eyes see images of things thrown on the eye-curtain, just as our own eyes do, even of huge things like the sun. And the horse obeys us, as other things do, because we have more mind than he has, and mind is master.

WHY DOES A STICK FLOAT?

We must remember that the earth is all the time trying to pull everything to itself; it pulls us, it pulls the air, it pulls a balloon, it pulls the moon. Now, the heavier the thing is, the more it is pulled, and water is heavier than a stick. This does not mean that all the water in a pond is heavier than a stick because, of course, we know that. But it means that, if you had a cup and filled it with water, and had another cup the same size and filled it with stick, the cup with the water would be heavier—that is to say, in a fixed amount of space you can pack a greater weight of water than of wood. That is what we mean when we say that the water is heavier than the stick.

Of course a pound of water is the same as a pound of stick, and you do not need to be told the answer to the question, Which is the heavier, a pound of feathers or a pound of lead? They both weigh the same, only the lead takes up less room, and so we say that lead is heavier than feathers, though a pound of lead weighs the same as a pound of feathers. The proper name for a heavy thing is *dense;* and whenever it is possible the earth pulls the denser things farthest down, and the less dense things float on the top of it. That is why the stick floats.

WHY DID THE SAND GET ON THE SEASHORE?

The sand found on the seashore or anywhere else is made of one of the commonest elements in the world, the name of which is silicon. In the part of the world that is not actually alive, silicon corresponds to carbon in the living world. They are very similar elements, and they both combine with oxygen to form compounds called oxids. In the case of carbon this is carbon dioxid, but in the case of silicon it is the sand of the seashore, which is also found in many other forms.

Ages ago, when the earth was hotter than it is now, its crust was formed by certain things turning solid, and one important fact of that time was that the element silicon was burned up with oxygen, of which there was enough and to spare. The common name for the compound of silicon and oxygen is silica. The making of silica by the burning-up of silicon was the first step toward the sand of the seashore.

Now, a great portion of this silica, made up of very tiny grains, became glued together by means of other softer substances so as to form the sort of rock called sandstone. And when this rock is exposed to water and wind, they break down the sandstone into the grains of sand of various size that we find on the seashore. It is really all burned silicon. And even a small depth of it, a few feet, contains as much oxygen as is to be found in all the air above it. Some sand comes from the breaking-down of other rocks.

HOW CAN A NEWSPAPER BE MADE FOR A CENT OR TWO?

If only a single copy of a newspaper were to be made, it would cost hundreds of thousands of dollars. If everything required had to be made for the purpose, it would cost many millions of dollars in railways, and cables, and ships, and telegraphs, and telephones, and mines for the

iron to make the printing-presses, and countless other things. It is only because all these things exist already, and serve many other purposes as well, that it is possible to have a newspaper at any price at all.

But even granting that all these things exist, and even realizing that a mere newspaper is really a product and an expression of *all* the greatest facts of civilization, it would still be impossible to produce a single copy of a newspaper for two cents. That would not go far to pay for the printing of it, and to pay all those who write the articles and send the news which sometimes they have gathered in far-off countries, sometimes at the risk of their lives.

But if a million people, or even a few hundred thousands, all want the newspaper, then all their cents together will make it possible to get it. To print one copy of the newspaper may cost hundreds or millions of dollars, according as we reckon all the things it depends upon; but to print two copies will cost just a trifle more than to print one, and there is the secret. Merely to strike off copies costs much less than we give for them, and so, if enough of us ask for a thing, we can, by clubbing together, get for little what none of us, alone, could afford to pay for if he devoted his life to saving up for it.

DO CATS AND DOGS EVER CRY?

Cats and dogs may be terribly unhappy —far more than unhappy enough to make them cry if they were human. Yet we know that neither cats nor dogs ever do anything which can fairly be called crying.

Of course, they have tear-glands, as we have, because the front of their eyeballs requires washing and moistening, just as our eyeballs do; and it may be that their tear-glands produce tears more quickly at one time than at another. But it cannot be said that cats and dogs ever cry.

It would be interesting to study the kinds of animals that come nearest to mankind, and see whether crying is to be found among them. The animals nearest to us are monkeys; and among these there are four kinds, called apes, which are much nearer to us than the others. There is no question at all that they laugh and grin. But no ape cries, and, indeed, we are the only creatures that cry. Why this is so, no one can say.

DO WE SEE OURSELVES IN DREAMS?

There is no reason why we should not see ourselves in dreams, and certainly many people do see themselves. The greater number of dreams are visual—that is to say, they have to do with vision, or seeing. We do not so much *hear* things said as *see* people doing certain deeds. That is because in most brains the vision part is most important, and has been most excited during the day.

We shall be more likely to see ourselves in our dreams when our attention during the day has been very much directed to ourselves. If something has happened to us and we have been much looked at; if we have been singing or acting or speaking or reading; and if we have been thinking how we looked when everyone was looking at us; or if we have been looking at ourselves in a glass, or even looking at photographs of ourselves—in all such cases as these we are very likely to see ourselves in our dreams.

WHY DO WE BECOME EXCITED WHEN WE ARE PLEASED?

Pleasure is a state of feeling, or emotion. These states of feeling may all be classified in two groups, on the pleasure side or on the pain side. All the states of feeling and emotion that lie below the neutral line, and belong to the more or less painful class, act by depressing us: they reduce our activity. A man stricken by terrible grief may remain huddled up and motionless for hours. Pain and painful feelings lower the tide of life.

On the other hand, the pleasurable feelings stimulate: they raise the tide of life. Just as the others lessen activity, so these increase activity. The happy man wants to jump and dance and shout and throw his hat in the air. Children show all these facts more clearly than grown-up people simply because older people hold themselves in check. But what happens is really the same in both cases.

WHY IS THE SKY IN ITALY SO BLUE?

The sky is blue because certain tiny things in the air catch the tiny waves that form the blue part of sunlight, and then throw the blue rays to our eyes. If they did not do this, the sky itself would be dark.

We think of the sky in Italy as being blue because poets have sung of it so often. But it is really not any bluer than

the sky in other places in the same latitude. In places that are nearer the Equator the sky is still bluer, because the sun's rays strike it more directly, and therefore more brightly. This means that there is a greater quantity of blue rays, as of all kinds of rays, coming through the air; and the reason why the air is bluer is that the particles of it have more blue rays to catch and reflect to our eyes. We must always remember that when we speak of the sky's being blue it is really the air that is blue; and the color that seems to come from so far away is reflected from only a few miles away. One reason why we think of the sky of Italy as bluer than ours is that Italian cities do not send so much dirty smoke into the air as many of ours do.

WHY IS THE RAIN SOMETIMES HEAVY AND SOMETIMES FINE?

One condition must always be present before the water-vapor in the air can condense into the little liquid drops which, if they fall, we call rain. That condition is that there must be some solid nucleus, as it is called, for the water-vapor to condense upon. It is quite possible that one of the reasons why raindrops differ in size is the difference in size of the specks of solid matter—dirt or dust—round which they gather.

But we have lately learned that sometimes electricity may act on the gases of the air and split up the molecules of those gases, forming tiny things which are able to act as specks for water-vapor to condense upon. The size of raindrops may also be affected by the level at which the rain was formed, and when a very sudden change of temperature has caused them to form very quickly they may be quite a considerable size.

WHY CANNOT FISH LIVE IN THE DEAD SEA?

The Dead Sea was first so named by the great writer Jerome because no form of animal life is found in it. This can readily be explained when we study the composition of the water. It would, in the first place, be difficult or impossible for a fish to keep under water—which is as necessary for it as it is for us to keep above water—in the Dead Sea, so dense is the water, owing to the salt. And, in the second place, the salts found in the water include some which are powerfully antiseptic, or fatal to life, particularly the lower forms. There is actually in it three per cent of the salt called calcium chlorid, which is very poisonous to all forms of life. More than half the salt of the Dead Sea consists of magnesium chlorid, and its composition is thus very different indeed from that of ordinary sea-water.

WHY SHOULD WE HAVE STATE FLOWERS OR NATIONAL FLOWERS?

There is no reason why we should have a state flower or a national flower unless it means something to us, but it usually means a great deal. You remember in Hamlet, Shakespeare makes poor Ophelia say, "There's rosemary, that's for remembrance." All flowers are for remembrance, and we want national flowers to help us to remember.

The flag is a high and holy symbol. It teaches us to remember the might and majesty and the honor of the nation; its loyalty to justice and truth, and the purity of its great ideals. But, after all, just as every nation is made up of individuals and families, for each one of us our country centres round our home. The flower that grows beside the doorstep, by the spring, down in the orchard, or in the field beyond the wood, speaks to us of that home. When you grow older you will realize how a flower, or even a whiff of its odor as you pass it by, brings back to you some scene of your childhood days; perhaps to some flower-scented day in summer when you proudly stood up, saluted the flag and vowed allegiance, which meant, of course, that you would do nothing in all your life that would bring dishonor on your country's name.

So we say flowers are for remembrance, and the state or national flower is to keep us in remembrance of our homes and our country.

The oldest of the national flowers is the violet, which was adopted by the city of Athens in the days of its glory. Then comes the shamrock of Ireland, though the leaf, and not the flower, in this case is the national emblem chosen. Most of us know the story of how, when his pagan listeners could not understand the Christian doctrine of the Trinity, St. Patrick picked a spray of the shamrock which bloomed on the ground at his feet. "Do you not see," he said, "in this wild flower how three leaves are united on one stalk, and will you not then believe what I tell you, that there are indeed three Persons and yet one God?" On St. David's Day in the year 640, when the Angles and

Saxons were still strangers in England, the Britons of Wales, with Caedwalla as their leader, sought to drive the invader away from the rocky fastnesses where they had taken refuge. To distinguish him from the foe, each man in the Welsh army plucked a leek and placed it in his cap. The Welshmen were victorious, and from that day on the leek has been the national emblem of Wales.

The story of the Scotch emblem is something the same. The Danes, who invaded Scotland in the eleventh century, sought to take a fortress by surprise, and removed their shoes to swim across the moat at night. In the darkness they plunged into the moat, to find that it was full of thistles instead of water. Their cries of pain warned the garrison, and the attack was repulsed. Scotland was saved, and in remembrance of the victory the purple thistle flower was adopted as the national flower.

The rose of England brings us back to the Wars of the Roses, when the Yorkists wore a white rose and the Lancastrians a red rose as a badge. Henry VIII, a Lancastrian, married a daughter of the House of York, and made a red and white rose the badge of England.

Louis VII of France took the white fleur de lis, probably the white iris, for his badge, when he went to the Holy Land on a crusade, as a symbol of the purity of his motives. Since that time the lily has been looked upon as the emblem of France. Before the tricolor became the flag of France the white lilies on a blue ground led the French armies forward to many a glorious field of battle.

The blue cornflower reminds the German people of Queen Louise, the brave and gentle queen of Prussia who, when she fled to the fields to escape being taken prisoner by Napoleon in Berlin, amused her children by weaving wreaths for them of this pretty flower.

The maple tree has always had a peculiar place in the affections of the Canadian people, and early in the history of the country the maple leaf was adopted as a national emblem. Canadian children sang of it joyously; now they sing of it proudly, and no Canadian can ever forget the traditions made by the men who wore it on the fields of France and Flanders during the World War.

The United States has not yet adopted a flower, but most of the states in the Union have done so, and we give you a list of all:

Alabama—No choice
Arizona—*Giant Cactus*
Arkansas—*Apple Blossom*
California—*Golden Poppy*
Colorado—*Blue Columbine*
Connecticut—*Mountain Laurel*
Delaware—*Peach Blossom*
District of Columbia—No choice
Florida—*Orange Blossom*
Georgia—*Cherokee Rose*
Idaho—*Syringa*
Illinois—*Violet*
Indiana—*Carnation*
Iowa—*Wild Rose*
Kansas—*Sunflower*
Kentucky—*Trumpet Vine*
Louisiana—*Magnolia*
Maine—*Pine Cone and Tassel*
Maryland—No choice
Massachusetts—*Mayflower*
Michigan—*Apple Blossom*
Minnesota—*Moccasin Flower*
Mississippi—*Magnolia*
Missouri—No choice
Montana—*Bitter Root*
Nebraska—*Goldenrod*
Nevada—*Sagebrush*
New Hampshire—No choice
New Jersey—No choice
New Mexico—*Cactus*
New York—*Rose*
North Carolina—*Daisy*
North Dakota—*Wild Prairie Rose*
Ohio—*Scarlet Carnation*
Oklahoma—*Mistletoe*
Oregon—*Oregon Grape*
Pennsylvania—No choice
Rhode Island—*Violet*
South Carolina—No choice
South Dakota—*Pasque Flower*
Tennessee—No choice
Texas—*Bluebonnet*
Utah—*Sego Lily*
Vermont—*Red Clover*
Virginia—No choice
Washington—*Rhododendron*
West Virginia—*Rhododendron*
Wisconsin—*Violet*
Wyoming—*Indian Paintbrush*

Many of these state flowers have been chosen by the school children, but in some cases the state legislatures have named them. If a flower is adopted by the United States as a nation, it will probably be the goldenrod.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6283.

CABLES IN CITY AND COUNTRY

This man is splicing a cable in a cable manhole down below the street level. Through this vault many cables pass. Each is composed of scores of wires. New cables must be provided in advance to care for new subscribers. When a new instrument is installed, a wire leading from it must be connected with an unused wire in a cable leading to a control office. Each wire is labeled.

Between small towns a single wire, or a few at most, will often be able to take care of long-distance communication. However, the use of the long-distance telephone has grown so rapidly that between larger cities a few wires are no longer enough, but cables containing many wires must be provided. This is a section of a great cable between New York and Chicago as it goes over the mountains of Pennsylvania.

WHAT THIS STORY TELLS YOU

WHEN we speak a word we make the air tremble; every different word makes the air tremble in a different way. We call these tremblings air-waves. But an air-wave does not carry sound far enough, or fast enough, so we use the telephone, which changes the air-waves into electric waves, which travel along the wire quicker than sound travels from the tongue to the ear. When we speak into the telephone an iron disk changes the air-waves into electric waves, which travel along the wire to a disk at the other end. When they strike this disk the electric waves become air-waves again, and give off the same sounds as the sounds which made the waves. These sounds are the words from our lips. Our words strike one disk and become electric waves; the waves strike another disk and become the same words again.

THE WONDER OF THE TELEPHONE

CONTINUED FROM 6062

NOT very long ago, at a public dinner in a New York hotel, a telephone instrument stood at every place. During the evening it was announced that a gentleman in San Francisco, known to them all, would speak to his friends. The diners took up the receivers, and, clearly and distinctly, not only the words but the very tones of their friend came to them across three thousand miles of mountain, valley and plain. This was considered very wonderful, then, but greater wonders have followed.

The telephone has become so much a part of our daily life that we hardly realize how much we depend upon it until we try to think how difficult it would be to do without it. We call the doctor, the plumber, the grocer or the butcher; the business man uses it dozens of times every day; we call our friends to talk with them over our telephones. Over the wires come good news, bad news, sighs, laughter, with all the little tricks of speech by which we distinguish one voice from another. How is it done?

WHAT DO WE MEAN WHEN WE SAY THAT WE HEAR A SOUND?

You are told in the Book of the Earth that sound is the sensation produced upon our nerves by certain waves in the air. When we speak, air is set in motion; the waves beat upon the drums of the ears; the nerves of the ears report them to the brain, which translates them into words again. But these waves scatter in every direction, growing fainter all the time, or they may be broken up by other waves in the air. Therefore, you cannot hear the human voice very far away, and so we say we cannot hear because of the distance or the noise. This means either that the waves have become too weak to make an impression, or that other waves interfere with the speech-waves. Moreover, the sound-waves do not travel very rapidly. You have seen a flash of lightning and then several seconds afterward have heard the thunder; or you have seen the smoke at the mouth of a gun and later have heard the report. This is because the light-waves travel much more rapidly than the slower sound-waves.

Long ago it was found that sound-waves are carried much farther through some metals than through the air. A toy telephone was invented more than two hundred years ago, and any handy boy can easily make one. If you take two tin cups without bottoms, fasten a piece of parchment, or even tough paper, tightly over one end of each, make a tiny hole in the centre of each piece and stretch a wire between them, you have a telephone with which you can talk with your friend

across the street, or in the next house. This simple toy will not carry the waves very far, but from a beginning like this the wonder of the telephone has come.

MEN WHO ALMOST SAW HOW TO MAKE A TELEPHONE

In 1837 Charles G. Page, of Salem, Massachusetts, seemed to see that electric waves might carry sound; and in 1854 a Frenchman, Charles Bourseul, suggested that speech might be carried by electricity. He did not go on with his idea, nor did a German, Johann Philipp Reis, who made a rude electric telephone in 1860. It did not work very well, and the difficulties seemed too great to be overcome.

In 1874 Alexander Graham Bell, a Scotsman who lived for a time in Canada before removing to the United States, was making experiments with sound-waves, hoping to discover a way to help deaf children to speak. He found not only that sound-waves could be shown to the eye, but that they could be sent over the wires by electric currents. Another step and the human voice was carried for miles. Elisha Gray, of Chicago, was working on the same idea at the same time. On February 14, 1876, Mr. Bell filed an application for a patent in Washington. Just two hours later Mr. Gray made an application for protection of the idea.

The instruments of both were clumsy and crude. They were likely to get out of order and voices were not very distinct; but the principle was correct. The new invention made a great sensation at the Centennial Exposition at Philadelphia in 1876, but no one dreamed of the growth of the idea. The telephone was regarded as an interesting toy, and no one seemed to see that it was soon to become a necessity. Hundreds of improvements have been made since, and many new discoveries and inventions also. Many scientists are constantly employed. Indeed the laboratories of the Bell Telephone Company are said to be the largest industrial laboratories in the world.

This is one of the many central offices to be seen in a city. The wires from several thousand telephones all run into this office, and are connected to the back of the long switchboard which lines the room. Trunk lines which connect this central office with other central offices, or with other towns, are also brought in behind the switchboard, before which the operators sit. Now let us see how a telephone call is made.
All pictures in this article by courtesy of the New York Telephone Company.

HOW DOES A TELEPHONE WORK?

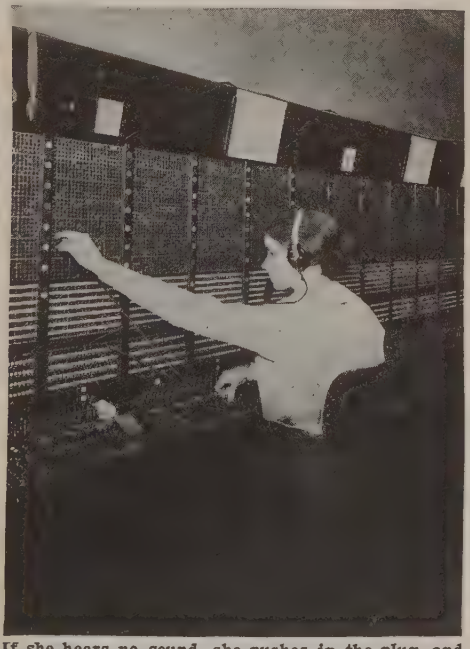
The actual process is very simple. The waves of sound from your mouth beat upon a disk in the mouthpiece of

WHAT HAPPENS WHEN YOU CALL

The subscriber finds the number of the man with whom he wishes to talk, and lifts the receiver from the hook. Immediately a tiny light glows under his own number in the central office. In some small central offices a magnetic signal operates.

The operator pushes one of a pair of brass plugs connected together into a hole, or "jack," above the light. This connects her with the subscriber. She asks for the number of the telephone he wishes. One should be careful to give the right number.

If the number is in the same central office, she picks up the companion plug and touches it to the lip of the jack. If a click is heard, she knows that someone is using that telephone and reports "busy."



If she hears no sound, she pushes in the plug, and then presses a button which rings the bell connected to the telephone desired. The person called takes down the receiver and conversation begins.

the telephone. This disk is connected with wires through which an electric current flows. The slow sound-waves are caught up and travel instantaneously to another disk perhaps miles away, which is set in motion just as the first disk against which you spoke. It gives out words to the listening ear. Your friend speaks against still another disk, and the waves from it strike the disk you hold to your ear and you hear the distant voice. We cannot explain this marvel. No one can tell why these vibrations should set up nerve currents which our brain transforms into words. It is all mysterious, but it is true, as you know. We may telephone to a lonely farm or to a fishing station on an island, as well as to our friends in a village or a city.

WHAT HAPPENS WHEN YOU CALL A NUMBER?

But everyone cannot have separate wires running to the houses and offices of everyone else. So all the wires run to a central office, called a telephone exchange. When you wish to talk to a friend you call up "central" by lifting your receiver from the hook, or, in a hand-ringing instrument, by turning a crank. A girl in the office answers, and when you give the number connects your wire with that of the one with whom you wish to talk. In large cities, where there are many telephones, all the wires cannot run into one office, but there must be many central offices, with such names as Chelsea, Riverside, Main and the like. Into such an exchange all the wires in a certain district run. When you wish to talk to someone in another part of the city "central" connects you with that exchange and asks the girl there to give you your number. The same thing happens when you wish to talk to someone in another city, and ask for "Long Distance."

GOOD MANNERS IN USING THE TELEPHONE

Sometimes it is even more complicated than this. Hotels and great business houses sometimes have dozens, even hundreds, of telephones, but these are not directly connected with a central office. Since all of these telephones will not be in use at once, only a few wires connect such a building with "central." There is a private exchange which you must ask to connect you with the central office, or which asks it to give you the number you wish.

If you cannot find the name you wish in the telephone book, you may ask for "Information." In every office there is someone whose duty it is to keep track of all new subscribers whose names are not yet in print, and to give their numbers to those who inquire. Though all this seems very complicated, it is done very quickly.

Generally it is only a few seconds from the time you lift the receiver until you hear an answering voice perhaps many miles away. Of course, if your friend does not hear the bell, or does not answer promptly, you will be delayed. It is good manners to answer at once, and to speak clearly and distinctly, with your lips near the mouthpiece, or transmitter, as it is called. It is not necessary to shout. You should be as polite when talking over the telephone as if you were in the presence of the person to whom you are talking. Nor should you become angry with the operators. In most cases any delay is not their fault, and if everyone spoke distinctly, few wrong numbers would be called.

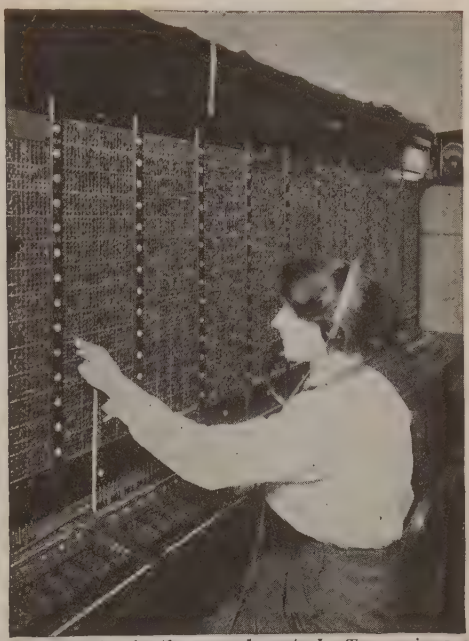
THE WONDERFUL GROWTH OF THE TELEPHONE

When Mr. Bell and his assistant, Thomas A. Watson, carried on the first telephone conversation, there were just two telephones in all the world. Now the Bell System in the United States and Canada connects more than 17,000,000 instruments, and there are many independent companies in addition. The wire over which Bell and Watson talked stretched only from room to room. Now this one system has a total of about 49,000,000 miles of wire, and employs about 375,000 men and women. A single spoken sentence began the history of the telephone. Now this organization alone will soon handle an average of 75,000,000 local and toll calls every day.

This growth seems like magic. However, all these achievements have been brought about by long years of patient study and experiment. To produce the transmitter now in use, for instance, over seventy types have been designed and discarded as newer and better ones have been produced. Similarly, the receiver has been improved fifty times in order to produce the type used to-day. There have been hundreds of other improvements in the methods and materials used in making wire and cable, in the compli-

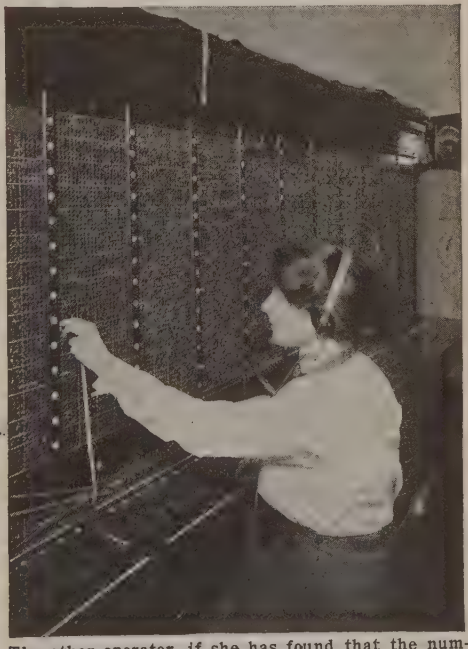
CALLS BETWEEN CENTRAL OFFICES

Many calls, however, are for other central offices. If this is one, instead of pushing in the plug, she presses a button which enables her to talk with an operator in that central office, and asks for the number desired. Let us see what the other operator does.



The operator in the second central office assigns a trunk line between the two offices, and then picks up a plug connected with that trunk and tests the number desired to find whether it is busy. Trunk lines connect every central office with every other.

The operator in the office where the call originated meanwhile picks up the companion to the plug already inserted in the caller's jack and inserts it in the jack of the trunk which has been assigned.



The other operator, if she has found that the number desired is not busy, inserts the plug belonging to the trunk in the jack. The bell belonging to the telephone desired then begins to ring.

cated mechanism of the switchboard, in apparatus for testing the lines, and so on.

How the Dial, or Machine-Switching, Telephone Works

In some communities the dial telephone is being installed with success. It is intended to prevent mistakes and to do away with the large number of girls in the central office. The system seems rather complicated, and we cannot stop to explain the exact way it works, but this is all the subscriber sees. To an ordinary instrument a dial is attached with a figure showing through each of ten holes the size of your finger. When you wish to call a number you remove the receiver from the hook, put your finger in the hole through which the first figure of your number shows, and rotate the dial until it stops. When released it returns to the original position. You then turn the dial for the second figure, and so on, until your number has been completed. Then the bell of the number you called begins to ring. Where there is more than one central office, letters also show through the holes, and you must rotate the dial for the first letters of your central office before you begin to move it for the figures. When you hang up the receiver the connection is broken.

Inventions and Discoveries of the Telephone Engineers

Other inventions of the telephone engineers have attracted attention because of the spectacular results, though some of these do not have much to do with regular telephone service. One of these is the telephone amplifier, or loud speaker. By means of this apparatus great crowds are enabled to hear a public speaker. These instruments enabled a crowd of 125,000 people to hear every word of the inaugural ceremonies when President Harding took the oath of office. They were later used at the Burial of the Unknown Soldier at Arlington on November 11, 1921, when an audience of 100,000 in and around the great national cemetery heard every word of the exercises. Similar amplifiers in New York and San Francisco were connected with Arlington by long-distance telephone lines. Long-distance telephoning has also made great strides. Early in 1924 San Francisco talked to Havana, Cuba, over a telephone circuit 5,000 miles long, and millions of people "listened in" through six radio broadcasting stations which had been connected with the circuit.

Telephone engineers have also studied radiotelephony, and as early as 1915 succeeded in sending the voice of man through the ether from Arlington to Paris and to Honolulu, Hawaiian Islands. Again in 1923 they talked from New York by wire and radiotelephone to a group of scientists and representatives of the press in London, England. Passengers and officers on vessels at sea have talked by radio with telephone subscribers on shore, the latter using regular telephone instruments in their own homes or offices. This shows how radio and the wire system can work together.

Telephone engineers have also sent photographs over a telephone line. This system was used in providing the New York papers with news pictures of the Republican National Convention at Cleveland early in June, 1924. Pictures were also transmitted to Chicago during the Democratic National Convention, held in New York. Radio engineers are also working to the same end and have sent pictures across the Atlantic.

These are interesting and spectacular achievements of the telephone engineers. But their most important and most remarkable achievement, after all, is the construction and maintenance and operation of a system which at any time can give direct and personal communication between any two of millions of subscribers in over 70,000 different communities.

Telephones in the United States and Canada

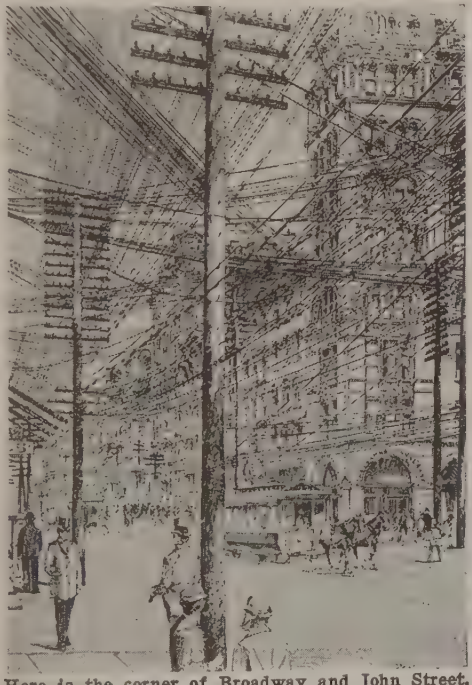
No other countries have so many telephones as the United States and Canada, and nowhere else is the service so quick, so cheap and so good. In most parts of Europe few private houses have telephones, while in the United States and Canada there are many towns where nearly every office or dwelling has one or more. In the country districts you may see the telephone poles and wires along every road. The farmer and his family can talk with their neighbors, or with the people in the towns. In these countries there is a telephone for every seven people. Not all of these rural telephones have a separate wire for every subscriber. Several instruments are often attached to one wire, and different signals call the subscriber desired.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6363.

THE END OF A TELEPHONE CALL

The person who is called hears his bell ringing, takes his receiver from the hook, and at once conversation begins. All of these different steps have taken only a few seconds from the time the first man lifted his receiver from the hook, perhaps many miles away. It seems very wonderful.

In large cities the wires are usually carried underground in lead-covered cables made up of many separate wires. Here we see the vault underneath a central office. Each of these cables carries many wires from the street to the switchboard, which we have shown on an earlier page.



Here is the corner of Broadway and John Street, New York City, about 1890, before the wires were put underground. In times of sleet or storm wires often broke and this interfered with the service.

This is the same corner to-day. Though there are many more telephones in use, the wires have disappeared from the streets and are carried underground in the cables shown in our pictures.

THE FIERCE INVADERS OF AUSTRIA

The Hungarians of to-day are descended from fierce, cruel warriors, who swooped down upon Europe in the ninth century and ruthlessly destroyed everything in their path. After a time these Magyars, as they were called, adopted Christianity, and became the most important people in the Austrian Empire.

Although Austria joined with Prussia and Russia in 1772, to divide up the kingdom of Poland, only ninety years before, Austria had been saved by the Poles from destruction. The Austrian Empire had been overrun by a Turkish army, which was on the point of capturing Vienna, when John Sobieski, the king of Poland, appeared on the scene with an army, relieved the capital, and drove the Turks out of the Austrian dominions. Here are the Polish troops with their prisoners after they had beaten the Turks.

© Burton Holmes, from Ewing Galloway, New York.
Parliament House, Budapest.

AUSTRIA'S RISE AND FALL

CONTINUED FROM 6089

IN the story of Germany we see the immense importance of the great south-to-north highway of Europe, the Rhine. Let us now turn to the great west-and-east highway, the mighty Danube.

It is twice as long as the Rhine, for there is a course of nearly two thousand miles between its source in the Black Forest and the delta in the Black Sea. Some four hundred tributaries join it on this long journey from west to east —little rills in the Black Forest, icy streams from the snowy masses of the Alps, full swelling rivers from the great circle of the Carpathians, besides the rivers that drain Rumania and Bulgaria.

From the earliest times the old peoples of the world pressed out of Asia into the heart of Europe, chiefly by the great highway of the valley of the Danube. There were the old Celts, the early Teutons, and the later hordes that destroyed the old Roman Empire. The Danube was the empire's chief boundary on the north.

It was toward the end of the eighth century, when Charlemagne was steadily gathering the rule of Europe into his strong hand, that a province grew into shape on the Danube, near the end of the Eastern Alps. This was the boundary of Charlemagne's empire, the eastern outpost of the German peoples forever fighting back the oncoming Slav races from the East. This province is still called the East Kingdom, for that is the meaning of the name Austria. From the kernel of the two states of Upper and Lower Austria on the Danube the dominions of its rulers gradually spread over the kingdom of Bohemia and Moravia to the north, over the mountains that shut in Bohemia to a strip of country beyond the northern slopes of the Carpathians, now called Galicia. Southward, too, the Austrian dominions spread, and absorbed Tyrol, the Eastern Alps and the provinces between the Danube and the Adriatic.

For six hundred years the story of Austria was the story of the dealings of a family, the family of the Hapsburgs, with their neighbors. When Rudolph of Hapsburg, in the thirteenth century, was chosen by the electors to head the German states as Holy Roman Emperor, few guessed the character of the man who was to do so much toward establishing the fortunes of his house. In the story of Germany we read of the extraordinary rise to power of his descendants, of Maximilian, Charles V and many others, and how by conquest, treaty and marriages they gained possession of Tyrol, the Netherlands, and Spain with its empire stretching far west across the ocean.

With some exceptions the title of Holy Roman Emperor remained with the Hapsburgs, causing them to be much mixed up with the pope and the kingdoms and duchies in Italy. Unhappily, the connection with Spain, always fervently Roman Catholic, nourished in Austria a bitter spirit with regard to the Reformation, and during the terrible Thirty Years' War the Hapsburgs were chiefly to blame for the prolonged ruin and misery spread over all the German states.

Bitter and cruel were the persecutions practiced by the rulers of Austria in the states that fell under their despotic and narrow rule, and nobody is sorry that it has now disappeared forever. Mr. Gladstone once said that nobody could put his finger on a map of the world at any point and say with confidence, "There Austria did good."

THE CRUSHING OF BOHEMIA AND THE SPLITTING-UP OF POLAND

To the north of Austria lies Bohemia, the country of the Czechs, whose relations with Austria were ever changing. Now Austria was subject to Bohemia, and now Bohemia was subject to Austria. Long and gallant were the struggles made by the Bohemians to preserve their liberties and their distinctive language; but the Austrians, though frequently checked, finally became stronger in their power over the country.

At last, in the Thirty Years' War, even the victories of the Swedish king, Gustavus Adolphus, could not save them, and for long years the stifling rule of Austria became fixed, so that progress and national feeling, and even language, seemed to be crushed. But not hopelessly so.

Bohemia took a brave share in the struggles for freedom that went on in Europe during last century, and many of her hardships were removed at last. She won religious liberty, self-government, representation in Parliament at Vienna, and freedom to revive Bohemian literature and art and her mother-tongue.

Bohemia lies in the basin of the Elbe, which, like the Oder, drains to the north. By these rivers, through the encircling ring of mountains, we pass to the province of Galicia. This, too, was settled in the far past by a Slav nation, the Poles. Constant and bewildering were the changes that came to them through the centuries. About the time William of Normandy was conquering England the Poles were forcing their way through the Carpathians and overrunning the great plains. Four hundred years later the king of Poland was chosen to be king of Bohemia.

THE LITTLE PIECES OF PAPER THAT CALLED THE TYROLESE TO ARMS

When the Tudors were making themselves absolute in England, Poland was extending its borders in every direction and securing reforms of many kinds. After that it lost its independence, regained it, lost it again, and suffered much. We see it flashing out in brave deeds—as in the relief of Vienna, when it drove away the Turks; and then comes the sad story of the sharing-out of this ancient kingdom among stronger powers, Austria's share lying chiefly in the province of Galicia.

South of the Danube other Slav races settled, as well as Teutons and Italians; and many states of mixed nationalities grew up and were gradually absorbed by Austria. At Innsbruck, the capital of Tyrol, is a bronze and marble memorial of the union of Tyrol with Austria over five hundred years ago. The famous tomb of the emperor Maximilian is in the cathedral there, though he is buried elsewhere. But more interesting than all the reminders of kings in Innsbruck are the relics and monument of the patriot Andreas Hofer, who made such noble and determined efforts to defend his fatherland from French oppression. "It is time," he wrote on little bits of paper, and cast them to the hurrying streams to carry far and wide, and rouse the Tyrolese, ready and waiting to fly to arms at his call. We read his story on page 4588.

Salzburg is another famous Austrian town south of the Danube. The town of Enns gives a link with English history in the times of the Crusades. Its walls were built with the money gathered to pay the ransom of Richard I when he was captured on his way home through Austria.

THE ANCIENT KINGDOM OF HUNGARY AND ITS THOUSAND YEARS OF STRUGGLE

Of all the neighbors with whom Austria fought with varying success as the years rolled on, the most distinct and considerable were the Hungarians. A century after the Austrian state was formed, a race of people from Asia, the Magyars, quite different from the Teutons in stock and speech, burst through a gap in the Carpathian Mountains, swarmed down the great valley of the river Tisza,

AN EMPRESS'S APPEAL TO THE NOBLES

For centuries the sovereigns of Austria looked upon the Hungarians with suspicion, and forbade them to possess arms lest they should rise in insurrection. But when the empress Maria Theresa was attacked by enemies on all sides, and her throne was in danger, she took the bold step of appealing to the Hungarian nobles. Accompanied by her little son, she appeared before them, dressed in mourning and wearing the crown of St. Stephen, the first Christian king of Hungary, and her tears and eloquence moved the nobles to declare that they and their sons would die for her.

and on to the Danube, settling about its course where it makes a deep bend to the south. The kingdom of Hungary, which was thus founded, was larger than the United States of Austria. Its constitution is perhaps older than the British Constitution, and the story of its relations with Austria is one of incessant struggle to preserve its ancient freedom.

St. Stephen was Hungary's first king, and under him the Hungarians became a settled and civilized nation about a thousand years ago. He is a national hero. Hungary has been called the "bulwark and shield of Christendom," so often did it withstand the attacks of the Mohammedan Turks. The terror of these invaders along the old Danube highway hung over Europe for centuries, as the terror of the Danes hung over England. There was a Turk's tax with which to organize resistance or pacify the invaders with bribes. Poland, Bohemia and Austria had constantly to fight them, but Hungary, owing to its position, had to bear the brunt of their raids.

How the Austrians Tried to Destroy Hungarian Nationality

In the history of Hungary, full of progress, loss, alliance with neighbors and bitter wars with them, stand out many great rulers and soldiers. One of these soldiers, John Hunyadi, fought bravely as the champion of Christianity against the Turks. But the Turks fought bitterly and ruined the country by their warfare when a prince of the House of Hapsburg was elected king of Hungary as well as of Bohemia. The Turks did not like this, and for long years the unhappy country was desolated by war.

But Austrian rule had come to stay, against the wishes of the Hungarians. For over three hundred years there were heavy taxes, risings of the people, and every effort was made to destroy the nationality, language and free spirit of the Hungarians. Hope revived at times, and there was a glimpse of freedom when Hungary was recognized as an independent nation when the storm of the French Revolution was about to burst. But the privileges were lost again, and it needed years of patriotic endeavor through the first half of last century to wrest back, bit by bit, the ancient rights so long trampled under foot by the Austrians. In 1868 Francis Joseph, emperor of Austria, was crowned king of Hungary with the ancient crown of St. Stephen, after promising to govern according to the old constitution of the country. So it came to pass that the blood of the patriots was not shed in vain through the long years of struggle; for at last Hungary sat side by side, equal with Austria in the dual monarchy of the Danube.

The Many and Varied Peoples of the Old Kingdom of Austria

It must be remembered that there was no united Austrian nation, no common Austrian tongue. The empire consisted of a leading German state, broken off from the rest of the German-speaking peoples when Prussia rose to be their head; of various states which were fragments of other nationalities, some still speaking their own languages, some more or less absorbed by their German rulers. Besides these there was the independent nationality of the Hungarians, of quite different origin from the Germans, and possessing its own speech, manners and constitution.

The Magyars of Hungary were united with Austria only through the king, and hostile in feeling toward the other races within the empire. Bohemia and Moravia, the most flourishing part of the dominions, were inhabited largely by a Czech population which gloried in its past and had never lost the hope of regaining independence. Galicia was peopled by Poles in the west and Ukrainians in the east. The Transylvanian highlands of Hungary were chiefly peopled by Rumanians whose sympathy flowed toward the country of their own race and tongue. Southern Tyrol and Kustenland were restless because their populations were Italian. All the southern provinces—Carniola, Croatia, Slavonia and Dalmatia—were filled with people of Slav origin, like the Czechs and Poles of the north. Thus Austria was far more loosely held together than any other of the countries of Europe.

The Small Minority That Governed Large, Discontented Majorities

Yet, instead of trying to secure greater compactness and a closer union between her parts, Austria sought to gain more lands in the direction where there was greatest danger. When the Turkish hold on the Balkan peninsula began to slacken, Austria seized Bosnia and Herzegovina as parts of her empire, though the people were overwhelmingly Slav in race. Little

GLIMPSES HERE AND THERE IN AUSTRIA

The Opera House, Vienna.

The Hofburg Theatre, Vienna.

Castle of Waidhofenzell.

Votive Church, Vienna.

Schottwien in Austria.

Maria-Worth, a village in Austria.

Graz, a large town of Austria.

The Museum, Vienna.

The Charles Church, Vienna.

Photos, Cutler, E. N. A. McLeish, York & Son and others.

more than one-third of the people of Austria were of the German-speaking Austrian stock. Barely more than half the inhabitants of Hungary were Magyars, or racial Hungarians. Thus, throughout the dual empire there was government by a minority of discontented majorities, who wished for the freedom they saw enjoyed by neighboring races. Three-fifths of the population of the whole empire of Austria were of Slav origin.

THE EVENTS THAT BROUGHT EUROPE'S OLDEST EMPIRE CRASHING DOWN

These facts must be realized if we are to understand how, in the World War, the oldest empire in Europe crumbled suddenly into pieces. When the crash of defeat came, in the great European war, more than twenty million Slav people —Czechs, Croats, Slovenes, Bosnians and Serbs—formed themselves into two countries, leaving the Austrians and Hungarians proper quite small states. Yet the amazing start of the war was an attempt to crush out of existence the one free Slav country, Serbia.

The heir to the Austrian crown was murdered in the summer of 1914 when visiting Sarajevo, the capital of Bosnia. The Austrian Government fixed the blame on the neighboring country of Serbia, and imposed such heavy punishment that it was clear the murder was used only as an excuse for bringing Serbia under Austria. Germany arranged and supported these terms, for she had a treaty of alliance and defense with Austria.

Of a population of nearly fifty millions probably not half of the Austro-Hungarian people were in favor of the war, and in no direction was the Austrian fighting successful unless it was strengthened by a mixture of German troops.

THE NEW STATES FORMED AS A RESULT OF THE WORLD WAR

The Serbians, Russians, Italians and Rumanians were all successful until German troops were drafted to the Austrian fronts. The explanation was that only the German and Hungarian races in Austria-Hungary had any deeply rooted sympathy with their Government.

On the third of November, 1918, eight days before the armistice with Germany was signed, the Austrians unconditionally surrendered, after four years and three months of war. Three days before Bohemia and Moravia had joined together and proclaimed the Republic of Czecho-Slovakia in the north; while the southern Slavs had agreed to form in the south, with Serbia, the kingdom of Jugo-Slavia (or Greater Slavia). The young emperor Carl, who had succeeded the old emperor Francis Joseph, disappeared into private life. Austria and Hungary each formed a republic, while Transylvania was annexed to the kingdom of Rumania. Later, under the terms of the Treaty of Versailles, southern Tyrol, the peninsula of Istria, and the district northward known as Kustenland were ceded to Italy. Part of Galicia passed to the Russian State of Ukrainia, and part to Poland.

These changes left the proud empire of Austria an entirely inland state, cut off from the sea by Jugo-Slavia and Italy, and reduced to a population of seven and a half millions. Hungary, confined to a region where the Magyar race is in a majority, now has a population of only ten millions.

Thus, from the ruins of the Austro-Hungarian Empire rise the two considerable powers Czecho-Slovakia and Jugo-Slavia. Rumania, which absorbs Bukovina from Austria, Transylvania from Hungary, and Bessarabia from Russia, is nearly twice as large as Austria and Hungary together, and has a million more population.

THE SAD STATE OF A CITY WITH CENTURIES OF HISTORY

Though the Austrians, as a governing race, have never been successful, yet with people who are not governed by them they are liked. They have courteous manners and none of the coarseness of the Prussian character; and they have borne their misfortunes as becomes a people who have played a big part in history.

Especially does the great city of Vienna, their capital, put sadness in the hearts of those who know it, for it has a long and splendid history on the boundary line between the civilized West and the barbarian East. It has been the centre of Austrian art, learning and industry, and has been made, in planning and architecture, worthy of its place in history. But how it can be supported, now that Austria is reduced to a few provinces with inconsiderable manufactures and raw materials, we cannot say. Already its population is rapidly shrinking in numbers.

Austria still has valuable mineral deposits in Styria, Carinthia and Lower Austria. She has opportunities for manu-

THE DIVISION OF AUSTRIA-HUNGARY

The old dual monarchy of Austria-Hungary included many peoples of many races, but only the Austrians and the Hungarians had any real voice in the government. After the World War, Austria and Hungary were separated, and parts of the territory went to Poland, Czecho-Slovakia, Rumania, Jugo-Slavia and Italy. The heavy black line shows the old boundary. Now Austria and Hungary are weak in population, territory and resources, as large areas containing millions of people have been given to other states.

facturing, but her richest industrial districts now belong to Czecho-Slovakia, and Prague will grow as Vienna declines. A great deal of the country that is left her is mountainous and beautiful, as the remnant of Tyrol around its lovely capital of Innsbruck, and the delightful Salzkammergut, a lake area inclosed by mountains, with the ancient town of Salzburg at its entrance. But these alluring mountain lands are barren, and their products do not support large populations. Of the dozen chief towns that once were Austria's proud boast only Linz on the Danube and Graz in Styria remain to keep Vienna company.

The greatest natural feature of the country, and the most helpful, is the noble Danube, which passes through the heart of the land in stately flow. It comes from Bavaria and links Vienna with the Hungarian capital of Budapest, before it roars through the Iron Gates and reaches Belgrade, Serbia's capital. Then it crosses the Rumanian plain, and makes the boundary between Rumania and Bulgaria.

Once Austria was in a position to regard the Danube almost as her own. Now she is only one of the smaller partners in its usefulness to Central Europe. So have the mighty fallen; so does high ambition bring the strongest to their doom.

The condition of Austria after the war was so terrible that the sympathy of the world was drawn to her. Industry was at a standstill. Financially the country was ruined beyond recovery unless help from outside could be had. Vienna was in a state approaching famine. Her children were suffering terribly from want. These little ones had done nothing to cause war, but they suffered disease and want because of it. Their condition touched the hearts of the people of more prosperous nations, and thousands of children were brought into other lands to recover their strength and health. Large funds were raised, and food, clothing and hospital supplies were given out by the Red Cross.

To give more lasting assistance to a suffering nation—whose people were suffering for the most part in innocence—the League of Nations, in the autumn of 1922, worked out a scheme for the restoration of Austrian finances within two years under the control of a high commissioner appointed by the League. The Governments of Great Britain, France, Italy and Czecho-Slovakia agreed to guarantee a loan of $125,000,000 to meet the national debt during two years if the Austrians would, on their part, carry out certain financial reforms.

The Austrian Government exerted itself to work in concert with the League and the four powers. Though at the end of the two years the scheme had not fully succeeded, yet the state of the country promised well for the future.

This international rescue of Austria from a condition of bankruptcy was the most substantial contribution the League of Nations had made to the renewed prosperity of the world during the early years of its existence. It showed how real its help might be in enabling nations to save from ruin a hapless neighbor state. The result was a very substantial increase of Austrian industry and a renewal of public confidence. The new Austria has the good-will of all nations.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6339.

Brenner Pass in the Tyrol.

A street in Innsbruck.

A rugged Tyrol scene.

WHAT THESE STORIES TELL US

THERE was very little that came between the Indian and the great forces of nature. He lived at the mercy of the winter snows, and rejoiced with the forests in summer. He shared the habits of the beasts, "learned their names and all their secrets," thought of them as little brothers. For him each tree was inhabited by a spirit, every star the abode of magic. He knew how the hare came to have a split lip, and why the moon is flecked and shadowed.

INDIAN LEGENDS

HOW THE BEAR LOST HIS TAIL

IT was midwinter. The snow was lying heavy on the ground and the lakes were all frozen over. A Fox slunk softly over the snow, his feathery tail drooping forlornly behind him. He had had nothing to eat for days, and he was very hungry.

Presently through the trees he saw an Indian swinging along the trail pulling a sled-load of fish behind him. The Fox lifted up his nose and sniffed the air. Oh, how delicious! If he could only get hold of two or three of those fish! His sides fairly pinched him with hungry longing.

Silently as a shadow the Fox followed the trail of the Indian's sled. He noticed the bow and arrows slung over the Indian's back and the heavy club in his hand. He must not run the risk of being hit by that club. Ah, he had it! Breaking into a swift trot, he took a short cut through the woods and joined the trail about a quarter of a mile beyond. Flinging himself limply upon the ground, he lay there, his tongue lolling out, his eyes half closed and glazed. The Indian, coming along, saw the Fox lying in the snow, seemingly dead.

"What a fine skin for my wigwam," he grunted. And picking up the Fox by his tail, he flung the limp body upon his load of fish.

The Fox did not dare to move until he felt the sled slipping smoothly along under him. Then slowly, so as not to be heard, he pushed himself over to the edge of the load, and catching three of the biggest fish in his mouth, rolled off into the snow. Swift as a shot he was off into the woods with his booty. He met the Wolf, prowling along. The Wolf looked very lean and savage. His eyes brightened wickedly at the sight of the fish in the Fox's mouth.

"Where did you get that lovely fish, Brother Fox?" he asked smoothly, but he flattened his belly out along the snow as he spoke and crept a little nearer. Now, the Fox did not trust the Wolf. He told him how he had secured the food, backing farther and farther away, as he held the Wolf's attention by his tale.

"Why don't you go and do the same thing?" he finished hastily, and before the Wolf knew it the Fox was gone. The Wolf closed his jaws with a snap, as he realized how he had been fooled.

But he was starved and must have food, so he decided to try the Fox's plan. He saw the Indian coming through the wood and threw himself upon the ground as the Fox had done. But the man was not to be tricked a second time. As soon as he saw the Wolf he uttered a whoop, and seizing his club, pounded the animal's sides until it leaped up howling and fled into the woods. Murder was in the Wolf's heart. Everywhere he looked for the Fox, but in no place could he find him, and at last he gave up the search in despair.

Meanwhile the Fox was contentedly munching his fish under the shadow of

a big rock. As the last delicious mouthful slipped down his throat, and he sat there licking his whiskers and looking very happy, who should come lumbering along but the Bear. "How silly the creature looks, with his big paws and that long, bushy tail," thought the Fox. The Bear sniffed the air hungrily, and his round eyes inspected the Fox wistfully.

"Fish!" he mumbled, his mouth beginning to water. "Fish! Where did you get fish, Brother Fox?"

"What fun it would be to play a trick upon this stupid old Bear," the Fox thought. Aloud he said, "I got them out of the lake. If you will go down there and dip your tail in the water, the fish will bite. Then you can whisk them out upon the ground—all you want!" added the Fox generously.

"What a wonderful plan!" said the simple Bear, and off he set to the lake. Sitting down on the bank, he dipped his tail into the water and waited. He waited a long time, but no fish seemed to bite. He stretched his head around once or twice to see how his tail was getting on, but his neck was so short and fat he couldn't get even a glimpse of it.

Presently he began to get tired and his paws to get numb from the cold. "I will take a little walk and warm myself up a bit," he muttered. He tried to get up, but found he could not move. The ice on the lake had frozen in about his tail. He became very much frightened. "What shall I do? What—shall I—d-o-o?" he moaned to himself, fairly sobbing with terror. He pulled and pulled. Suddenly, with a snap he was free. But his long tail had cracked off behind him.

The poor Bear cast one despairing look at his beautiful, bushy tail sticking in the ice, and galloped off into the woods. Everywhere he hunted for the Fox, getting angrier and angrier every minute. When he found the Fox he was fairly growling with indignation. "Come and fight me," he snarled furiously. "You little liar, come and fight me!"

"What for?" inquired the Fox, innocently. "I have done nothing." Then he almost laughed as he looked at the Bear, with his big paws and his little stump of a tail flapping indignantly in the air.

"Oh, if that's what you mean," he went on, eyeing the remnant, "that's all your own fault, you know. You lost your tail because you were so slow." And flirting his own feathery plume under the nose of the exasperated Bear, he disappeared from sight. And this is how it came about that the Bear has a little stub of a tail, instead of a long, beautiful one like the Fox.

THE HAPPY LAND OF REST

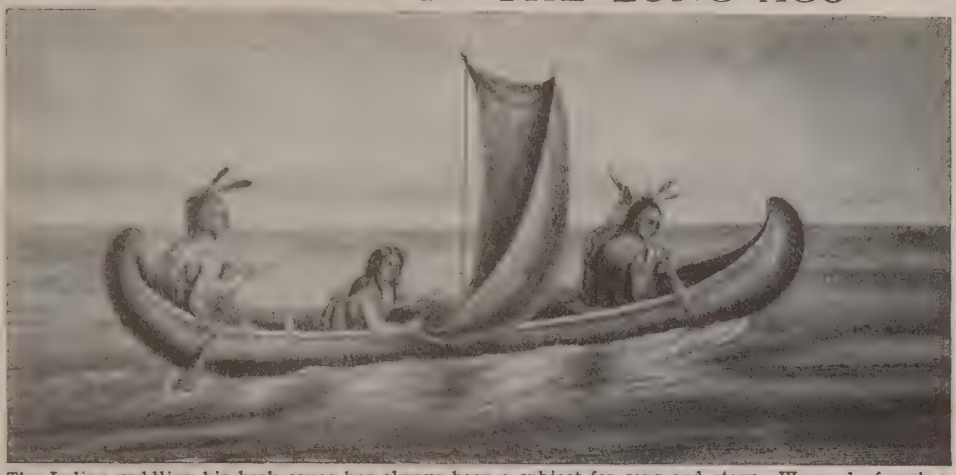
IT was a day of great weeping and wailing in the wigwams, for the beautiful bride of the young Chippewa chieftain was dead. The young chief's heart was very sad. With his head bowed on his knees he was sitting in the Wigwam of the Dead—the wigwam where his bride lay cold and still. He was a very brave young warrior, but he was not brave enough to bear his great loss.

As he sat there with the sharp pain of his sorrow in his heart, there came to him the sound of voices talking outside the tent. At first he did not pay any attention to what they were saying. Then he caught the name of his bride. They were speaking of her, and the land to which she had gone—the Happy Land of Rest. They said that mortals could reach that land if they would but travel far enough.

The young chief's heart leaped up. A great resolve came to him. He would seek his bride in that distant place. With a quick, firm step he passed out from the tent. He gathered together his bow and arrows and his many-colored blanket. He stained his body with paint and tied an eagle's feather in his hair. Then he called his dog.

"I am going on a long journey," he told his people, "a journey of many moons."

Slipping his snow-shoes on his moccasined feet, with his dog behind him, he set out over the snow, his face toward the south. Onward he traveled. Everywhere about him the land was covered by a heavy blanket of snow, and the trees crackled under the heavy burden of a thick coating of ice. No live thing was to be seen, save where here and there along the way the young Indian saw the shadow of a fox as it slunk off into the woods, or the white signal of a cottontail rabbit as it scurried away into the distance.



The Indian paddling his bark canoe has always been a subject for song and story. We read of such a canoe in various stories and in the song of Hiawatha, but the sail was seldom seen in the early days.

On pages 163 and 164 are some types of Indian houses. Here are others. This is the skin house used by the Winnebago Indians. It had a framework of wood over which were stretched skins sewn together and sometimes painted. The doorway or opening in the front was closed by flaps of skin.

This is a log cabin of the Creek Indians of Alabama sometime after the whites came. The log chimney was lined with clay. No nails were used, and the roof was held on by logs. The windows had no glass.

Presently the landscape began to change. The snow became less and less. Then it disappeared entirely. The Chippewa was in the Land of Spring. The trees were all covered with little green bud tips, and the brooks had broken loose from their icy covers and were singing along in the sunshine. The air became warmer and warmer, and the sunshine brighter and brighter. The Chippewa was coming to the land of singing birds, of deep blue skies and green fields filled with a tangle of wild flowers that waved in the breeze. It was the Land of Summer at last.

Ahead of him the young chief saw a pathway winding up a mountainside. At the top of the mountain there stood a wigwam, and the Chippewa could see an old man sitting at the wigwam door smoking a long pipe, from which the smoke rose in long curling wreaths toward the blue sky. As the young man drew near he could see that the Chieftain's hair was long and white, and that two keen eyes were watching him under the heavy white eyebrows.

"Father," the young man said when he reached the door, "I have come a long distance in search of my beautiful young bride. As I was sitting in the Wigwam of the Dead beside her, my heart bowed down with sorrow, I heard a voice which said that she had gone to the Happy Land of Rest. I know that I can find her if I do but travel far enough."

"Yes, my son," interrupted the old Chieftain kindly; "I have been watching for you. Come into the wigwam and rest."

When the weary traveler was refreshed, the old man spoke again. "She for whom you are looking passed here but three nights back. If you will do even as I tell you, you can find her."

"Yes, yes," assented the young man eagerly. "Tell me, O father, how I can find my bride."

"This is the gateway to the Happy Land of Rest," the Chieftain said. "Leave here your body, your bow and arrow and your dog, and you can enter there."

He took the young man out on to a ledge of high rock overlooking a great grassy plain that stretched out for many beautiful miles before them into the west.

"Go out yonder," said the old man, "and travel on until you come to a great lake of many waters. In the centre of the lake you will see a fair island. That is the Island of Departed Souls. On the shore of the lake you will meet your beloved."

The Chippewa traveled on many leagues over the wonderful plain, and as he went he noticed a very odd thing. Neither trees nor rocks nor rivers were any obstacle to his going. The wild creatures did not run away when he came near. A tiny fawn brushed against him, and cuddled its soft chin in his palm, and did not seem afraid. The young man could not understand. Then he remembered that he had left his body behind him in the lodge. This was the Land of Souls.

By and by he came to a beautiful lake. A leafy wood reached down almost to the shore, where a narrow ribbon of gleaming sand dipped into the water. In the middle of the lake was a wonderful island, where the young man could see trees and flowers, and could hear the sweet singing of birds that flashed to and fro in the sunlight. The waters of the lake stretched blue and inviting before him. Its ripples came lap, lapping upon the silver sand at his feet. The Chippewa looked down and before him he saw a great, shining, white stone canoe drawn up on the shore, and in the canoe lay a shining paddle all ready for his hand.

The young man climbed in, and as he lifted his paddle to dip it into the gleaming water, he heard a scraping of the sand behind him. Glancing up quickly, he saw another white stone canoe pushing off into the water by his side. In the canoe was his beloved, clad in her bridal garments, her dark hair divided into two shining braids that hung down over her shoulders.

For a moment they looked into each other's eyes. No word passed between them. Silently, stroke for stroke they dipped their paddles into the blue water and raised them dripping as they sped over the shining lake. With one sound their canoes scraped the shores of the island. Hand in hand they wandered over the beautiful island.

At last they sat down together on the shore in silence, hand clasped in hand, happy alone in their nearness to one another. As they sat there they suddenly heard a great wind sweep through the

trees over their heads, and on the wind came a voice.

"O Chippewa," the voice said clearly, "your time has not yet come to remain forever in the Happy Land of Rest. Many summers and many winters must pass over your head before that time shall come. The Chieftain at the Lodge will teach you many things of wisdom. Go back to your people. They are waiting for you. Teach them all that he, the Chieftain, shall instruct you. Your beloved will be waiting for you here, in the Happy Land of Rest, until you come again."

The young chief looked into the maiden's eyes. "Hush," he said. "It is the voice of Manitou, the Great Spirit."

Even as he spoke he awoke. His bow and arrows were by his side—his dog was lapping at his hand. Over him there bent the old man, the Chieftain of the Gateway of the Happy Land of Rest.

"Ah, my son, you have returned," he said. "I will instruct you that you may be the father of your people in their time of need."

Many things the old man taught him, of herbs that cure all sickness, of ways to help his people. At last the young chief returned to the wigwams of his tribe, to live out his life among them. A wise and brave chief, he ruled over them. And when all his days were done, he went again to join his beloved in the Happy Land of Rest, for the will of Manitou had been wrought and his rest was won. But there was great mourning among the Chippewas.

THE BRIDE OF THE FOREST

LONG ago there were many forests along the shore of the Big Sea Water. Near a grove of sacred trees an Indian village raised its wigwams. In one of the wigwams lived the chieftain with his wife and his daughter Leelinaw.

Leelinaw loved the forest, in its summer dress of green and its gorgeous raiment in the fall. She loved it even when the birds were all silent and it wore only a sober dress of brown covered by a snow mantle. Every day she crept away from the village and wandered in among the woods to a place where a brook bubbled over mossy stones and, breaking away from the forest, tumbled into the blue water of the Great Lake.

Here she would slip the moccasins from her slim brown feet and dip them into the sparkling water. For hours she would sit thus, dreaming, her cheek pressed against the rough bark of a tall young pine that overhung the brook. She listened to the leaves rustling and rustling —whispering to the water.

One day a great old war chief came to the village with many gifts. He wished to take Leelinaw away with him as his bride, but Leelinaw's heart was very heavy, for she did not love the old chieftain.

"Let your child have one more day in the grove beside the Big Sea Water before the great war chief takes her to be his bride," Leelinaw besought her father.

"It shall be as you ask," her father told her.

The little Indian maiden fled into the forest. Her swift feet carried her to the tall pine tree that leaned over the brook.

With her two arms around its rough bark, she whispered her troubles to the dear companion of her dreams. Presently through her sobs she heard a voice speaking gently in the rustling of the leaves.

"Do not weep, Leelinaw. Lean on me, for I am strong. I will take care of you. Stay here with me in the forest by the Big Sea Water. Stay with me forever, for I love you."

Leelinaw was comforted. She went back to the wigwams. To-morrow was to be her bridal day. Early the next morning before the village was stirring, Leelinaw arose. She dressed herself and slipped into the forest. When the village awoke, Leelinaw was gone.

The men of the village searched everywhere for the lost girl. But they could not find Leelinaw. Sunset came and she did not return. Many days passed and still Leelinaw could not be found. The old war chief returned to his own people without his bride. Her parents were broken-hearted.

One day they were paddling along the shores of the Big Sea Water. Suddenly on the shore where the brook dipped into the waters of the lake they saw Leelinaw watching them. Beside her stood a brave

who was tall and straight and slim. In his hair there waved a plume of bright green feathers. With one accord her glad parents rose up in the canoe.

"Leelinaw!" they called. "Leelinaw! Daughter, we are here!"

The girl waved her hand to them. Then she was gone. Quickly they rowed to the shore, calling, calling to her through the forest. But Leelinaw could not be seen. Two pine trees, tall and slim, rose in the spot where she and the young brave had been standing, and only the rustling whisper of the pine needles and the echo in the forest answered to their shouts.

WHY THE CHIPMUNK HAS BLACK STRIPES

ONCE upon a time, long ago, the animals had tribes and chiefs like the Indians. The Porcupine was the head chief of all the tribes because nothing could ever get near enough to hurt him.

One night the Porcupine sent out word calling all the animals together for a great council of the tribes. He had a very important matter for them to consider, he said. From far and wide, from north, south, east and west, from tree-tops and from holes in the ground the animals came hurrying in answer to their chieftain's summons.

They built a great blazing council fire in the forest and seated themselves around it in a big ring. Then the Porcupine stood up to address them, and his quills quivered and gleamed in the firelight. For a minute or two he did not speak. He looked very much worried indeed.

"I cannot decide," he said, "I cannot decide whether we shall have night or daylight all the time."

Whereupon there ensued a great commotion. Everyone had something different to say. Some wanted it daytime always, and some wanted it night. They all talked at once, and they all talked very loud so you could not hear what any of them were saying, except the Bear. He was rocking to and fro on his hind legs, trying to drown the others out by rumbling out in a big deep voice: "Always night! Always night! Always night!"

Presently a little Chipmunk who had been sitting on the outskirts of the council became exasperated. Chipmunks always hate to sit still for any time.

"You can talk all you like," he shrilled out in his tiny squeaking voice, "you can talk all you like, but the light will come whether you want it or not. The light will come."

The other animals did not pay any attention to him, but went on bawling and roaring and growling till they were hoarse, while the Chipmunk danced with excitement on the outskirts of the crowd shrieking: "The light will come! The light will come!"

And before they knew it a faint flush had crept up the sky, and the golden disk of the sun arose above the tree-tops. Shafts of sunlight touched the tops of the trees and fell in long beams across the open space where the council met. The fire looked weak and pale. It was daylight. An astonished silence settled down upon the gathered council of the animals. Could it be possible that it was daylight whether they wished it or not?

A shrill voice suddenly piped up from the edge of the assembly: "What did I tell?"

"Grr—rr—"

The Chipmunk was gone like a flash through the trees. The Bear was after him, but the Bear was clumsy, and the Chipmunk was quick so that he slipped into a hole in a tree before the Bear could catch him. As he disappeared the Bear struck at him with his paw. The black stripes that run down the Chipmunk's sides to-day show where the Bear's claws hit him long ago at the council when the animals were trying to decide whether they should have darkness or daylight all the time.

THE WHITE LILY

LONG, long ago, before the white men came to North America, the Indians were happy. The tribes did not go on the war-path and the great chiefs smoked together the pipe of peace. Game and food of all kinds were plentiful, and all the people loved one another. The days were long and very pleasant. The nights came very softly like a prayer.

Each evening the Indians would gather

at the doors of their wigwams and smoke. The smoke would curl gently about their heads while they talked and puffed. Each night they watched the stars come out, one after another, in the black blanket of the heaven. The Indians whispered to one another that the stars were the homes of those who had walked across the Starry Bridge of Souls.

One night the warriors stopped their puffing—their pipes held suspended in their hands. The women gave little murmurs of fright and crouched together. A Star had left the sky and had come half way toward earth. It seemed like a flaming flower of fire.

"Awee, Awee! What can it be?" cried the old women.

That night a young brave dreamed a dream about the wonderful Star. The next day he called a council of the wise men of the village.

"Behold," he said, "I dreamed the Star of Fire we saw last night came and stood beside me in my sleep. And the Star was a maiden, white and glowing and very beautiful to look upon. 'Brother,' said the maiden, 'I have seen the red people from my seat in the sky and I love them. Ask your wise men what shape I may take that I may dwell with the people of my love forever.' "

The wise men grunted all together as the young man returned to his seat by the council fire. For a while they smoked in solemn, thoughtful silence. Then rose one who had lived in the village so many winters that no one could remember the time when he was young.

"Let the Star Maiden choose for herself," he said. "She may live in the green top of a pine tree or in the soft heart of a flower. She may stay wherever she finds rest. She is welcome to come among us. Is this not so, my brothers?"

The wise men grunted and nodded their heads slowly. "We have spoken," they murmured.

So the Star came nearer and nearer to the earth, until she hid herself in a pure white rose upon the mountainside. Here she could see the red people of her love and could sometimes catch snatches of their talk.

But she was very lonely, and when at evening-time they stood at the doors of their wigwams, her heart yearned to be among them. So one day she left the mountain-rose, and coming down among the people of the valley, took up her dwelling in a prairie-flower. Every day great herds of buffalo went thundering by. The prairie-flower swayed to the motion of their hoofs, but they made the ground shake under the Star Maiden, and she was frightened. She was afraid that they would trample her under their volleying hoofs. At last she could not stand it any longer.

One day the soul of the Star arose from the prairie and floated over the land, seeking a place where she might rest and yet be near the red people of her love. The Indians saw and feared that their heavenly visitor was going back to the sky.

Softly the White Star floated on and on. The watching Indians lost her as she entered the softness of a fleecy cloud. By and by she came to a great blue lake. As she floated over it she saw her shadow in the water underneath, and she was pleased. Gently she sank down until she rested like a canoe upon the cool bosom of the waters.

The next morning the lake was covered with great white shining star-shaped blossoms, with golden fragrant hearts.

"The night stars have bloomed again in the water," chirruped the children, as, hand clasping hand, they bent over the water-edge to dip their noses into the big sweet wonderful flowers.

"The White Star has called her sisters down to live among us," the wise men told one another, nodding their heads.

And all the people went out on the lake in their canoes and chanted songs of thanks to the beautiful floating lilies.

"Wahbegwannee," they called them, "Wahbegwannee, the white Star Flowers."

Then the winds caressed the white flowers' petals, and the birds kissed their golden hearts. Through their long slender stems fish guided their darting course, and upon their flat green leaves dragon-flies sparkled like gems. The moonbeams wooed the sisters by night, but they shut up their hearts and denied them entrance, for they loved only the red people.

Then the heart of the Star Maiden grew full, for the joys and sorrows of her loved red people were at last her own. And the braves sat no more around the council fire, but smoked their pipes on the strand in sight of the lily-pads.

THE NEXT STORIES ARE ON PAGE 6317.

THE CHANGING SKY-LINE OF NEW YORK

This view made from an old print shows how the tip end of Manhattan Island appeared when viewed from Long Island about 1768.

This view of the same section of the city was taken from the water in 1889, over a hundred years later than the one above. Photo by Elmendorf, from Ewing Galloway.

In this view of lower Manhattan Island in 1926, the tall structure on the left is the Woolworth Building; the massive one in the centre, the Telephone Building, with the Singer tower over its right shoulder, and the Equitable and Bankers Trust buildings next on the right. You can imagine the skyline of 1900 by noting the two buildings at the right of the Woolworth. They were the skyscrapers of twenty-five years ago. The giants of yesterday are the dwarfs of to-day. Photo, Ewing Galloway.

Photo, courtesy The New York Historical Society.
Famous Castle Garden (now the Aquarium) as it was in 1847.

WHAT ONE MAY SEE IN NEW YORK

CONTINUED FROM 6048

THE harbors of a country are its gateways from the sea. Therefore we speak of the cities and towns which grow up beside our harbors as ports. They are the doorways through which people come and go, the portals to which the ships of all nations come bearing goods, and from which they sail away laden with the things which we supply them in exchange.

There are many ports on the eastern coast of the United States, but the greatest of them all is the great city of New York, the largest and most populous city in the world under a single government. On the streets of this great city we hear the tongues of all the nations, and see faces that tell us that the people have come from every clime. In the harbor and at the piers may be found the ships of every seagoing nation. Stores and warehouses are crowded with goods from every country in the world, and ships sail away every day laden with the goods with which these countries are supplied.

Within the boundaries of the city there are crowded streets, and immense public buildings, great museums, manufacturing centres, and even islands and farm lands. Brooklyn, a large city in itself, Long Island City and a number of smaller places on Long Island are all part of the great city, as are the section of the mainland to the north of the city, called the Bronx, which the Dutchman Jonas Bronck is said to have bought from the Indians, and Staten Island, which shelters the southern end of the harbor.

Most Americans, and nearly all foreigners, when they speak of the city of New York, think and speak of the Borough of Manhattan, which is built on the island of Manhattan, and has grown out of the first settlement made by the Dutch. It is of this part of the city that we shall principally speak to-day, and for the sake of convenience we shall speak of it simply as New York. It is here that the chief financial business of the city is carried on, here its great public offices are to be found, and here are also most of the shops for which the city is famous.

WHEN NEW YORK BEGAN TO BECOME A LARGE CITY

It was not until about the time of the Civil War that New York really began to grow rapidly, but since that time it has grown by leaps and bounds. Consequently it is one of the most

modern of cities. A house or office building that has seen forty years go by is looked upon as old. In fact, it is almost safe to say that the greater part of New York has been built within fifty or sixty years. As the city grew, streets that before were filled with private houses were turned over to business. Business houses were torn down to make room for larger buildings. The older part of the city has been entirely rebuilt. Few landmarks have been kept, and it is useless to look for the Old World charm that we may find in some of the older Eastern cities.

There are several ways by which we may enter this famous city, all of them interesting. We may come into the heart of the city through either of the two great railway stations, or we may cross the river by ferry boat from the New Jersey shore, or come down Long Island Sound in a coastwise steamer; or, best of all, if we are coming in from the sea, we shall sail up the outer bay, through the Narrows, across the beautiful landlocked inner bay, and up the mouth of the river, to drop anchor at one of the river piers. As we come up the bay we are struck by the great beauty of the harbor and by the wonderful sky line made by the tall buildings in the lower part of the city. If we sail in through the Narrows when the waters of the bay and Bartholdi's great Statue of Liberty are lighted up by the setting sun, the towers on the water-front seem to stretch up into the glow above them. Perhaps we may cross the river at dusk, or in the velvety darkness of a summer evening, and if we look up to the tops of the towering buildings as we approach them, and measure them with the lighted ferry boats that glide past us, we may gain some idea of their height.

Some of the Famous Buildings in New York

Some of these tall buildings are very famous. The Singer Building carries the top of its tower 612 feet above the street. The Woolworth Building, of which you will find a picture on page 6688, is over 790 feet high. The figure on the top of the Municipal Building stands over 550 feet above the pavement below. Farther uptown the tower of the Metropolitan Life Building is 700 feet high. The foundations of most of the tall buildings have been sunk down to the solid rock, in some cases 90 feet, and in others as much as 130 feet below the street.

Many of the buildings hold thousands of office workers. Eleven thousand people work in the Equitable Building, and at midday, when they pour out to luncheon, the high cañon-like walls look down on a wonderful sight. Crowds of men and women surge to and fro in the narrow streets of this old part of the city that is yet so new. At any time between noon and two o'clock Nassau Street is crowded from wall to wall with an endless procession. In the evening, when the crowds have been carried away by subway train, or elevated train, or street car, or ferry to their homes in the upper part of the city, in Brooklyn or some place on Long Island, or Staten Island, or in New Jersey, all these buildings are deserted. Then the empty streets look more than ever like cañons, and the walls of the deserted edifices send back hollow echoes to the footsteps of the solitary watchman on his beat.

Many of the buildings are handsomely decorated with fine doorways and windows, good carvings in stone, and statuary. The iron grillework of the elevators which carry the workers from floor to floor is well wrought; halls and corridors are lined with marble, or with the decorated tiles of which we have spoken in the Story of China.

Of course all the buildings are not so tall as those of which we have spoken. Many buildings are of moderate height, and some of the finest are only a few stories high. The Custom House, a square granite building, is one of the handsomest of its kind in the world; but we shall not speak here of the symmetry of the building, the beauty of its columns, the richness of its statuary. The picture in the lower left corner of page 6209 shows part of this building with its many columns. Three-quarters of the foreign commerce of the United States passes through the port of New York, and the customs department well deserves this fine building for its headquarters. It is believed that it stands on the site of the first fort that was built by the Dutch, and we know that it covers part of the ground on which old Fort Amsterdam was built. In front of it is Bowling Green, where the old Dutch governors played at bowls. The statue of King George III, which once stood in the centre of the green, was, as

BOWLING GREEN TO CENTRAL PARK

These two pictures show two of the entrances to Central Park at Fifty-ninth Street. On the left is Columbus Circle at Eighth Avenue, with the Statue of Columbus high on its column. On the right is the Plaza, with Fifth Avenue stretching away in the distance. Photos, Ewing Galloway.

Photo, Ewing Galloway.
From Battery Park Broadway stretches like a canyon. On the right is the Custom House, with the Standard Oil Building beyond.

© Ewing Galloway.
Hemmed in on all sides by high buildings, Trinity Church and Graveyard still remain on the original site. Alexander Hamilton is buried here.

we know, melted down for bullets for the Revolutionary army, and a statue of Abraham de Peyster has taken its place, but the old iron railing still remains. The round tops of the posts were broken off for cannon-balls.

Near Broadway, on Wall Street, which received its name from the wall of New Amsterdam, stands the Subtreasury Building, an immensely strong, fortress-like building in the form of a Greek temple. The shape and proportions of the Subtreasury are very fine; but much as we admire the simplicity of the building, the strength of its stone walls and Attic roof, and the severe beauty of its Ionic columns, we cannot help regretting that it was not built elsewhere. To make room for it, Federal Hall, in which the first Congress of the United States assembled, and in front of which the first president took his oath of office, was removed. In front of the building stands a statue of Washington.

Within a stone's throw of the Subtreasury is the Stock Exchange, the great stock market which is known all over the world as Wall Street. Visitors may be taken by members of the Exchange to look down from the gallery on the hubbub made by the buyers and sellers of stocks on the floor below. Near by, on Broad Street, is the Consolidated Exchange; on Nassau Street is the Chamber of Commerce; and not far off, on Liberty Street, is the Clearing House, where the great banks transact their business with one another. The Corinthian pillars and sculptured Greek front of the Stock Exchange, the fine frieze and dome of the Clearing House, and the statues in front of the Chamber of Commerce are the most notable features of these buildings. The men who spend their days in them control the business of a large part of the world's work.

THE SEAT OF THE GOVERNMENT OF A GREAT CITY

The centre of the city government is not far off, where the City Hall is set in a small park which keeps it apart from the noise and clangor that surround it. Much of the furniture that was used in Federal Hall by the first Congress is in the Governor's Room, and so are the desk and table used by President Washington; and there are some interesting portraits in the building, by some of the better known of the earlier artists of the United States. The City Hall, which was completed in 1812, is one of the few links with the past that remain in the city. It is a beautiful marble building in the style of the Italian Renaissance, and though the tall buildings that surround it overshadow it, they have not been able to dwarf it. The mayor has his office in the building. The aldermen meet here, and receptions to distinguished strangers are sometimes held in the Governor's Room. The Hall of Records, in which all the title deeds of Manhattan Island are kept, is just across the corner; and the Municipal Building, in which most of the city offices are situated, is close by. The Municipal Building is one of the largest and tallest buildings in the city. A street runs through it beneath a vaulted archway, and there is a station for subway trains beneath it.

We look in Madison Square for the Metropolitan Life Insurance Building, with its graceful clock tower like an Italian campanile. Few strangers cross the square when the famous clock strikes the hours without pausing to listen to its deep-toned bells. Fine views of the country which surrounds the city can be seen from this tower and from the tower of the Woolworth Building.

SOME FAMOUS STREETS IN A FAMOUS CITY

In the lower part of the city the streets are irregular, and all of them have names; but farther north they have numbers instead of names, and the city is laid out in regular oblong blocks, with their longer sides laid across the width of the island, so that even a stranger can easily find his way about. The shape of the city is so irregular, however, that Broadway is the only street that runs through it from one end to the other. Along the first part of its course this famous street runs straight, but farther north it "cuts corners" across the city, and on its irregular way toward the Hudson from Tenth Street to One Hundred and Eighth Street it makes a diagonal crossing of every one of the avenues from Fifth Avenue westward. This leaves odd triangular spaces, some of them large enough for a building, while some give a little open space for a statue or a plot of grass. On one of these triangles is the Flatiron Building, one of the most famous of New York's famous buildings. Another makes room for the building

WALL STREET TO MADISON SQUARE

The beautiful tower of Madison Square Garden, designed by Stanford White, was an ornament to Madison Square until it was torn down.

The tower of the Metropolitan Life Building facing Madison Square contains many offices. The clock is enormous and the chimes tell the hours.

The New York Stock Exchange is the most active market for securities in the world. This picture was made from the Subtreasury Building.

The Washington Arch stands in Washington Square at the foot of Fifth Avenue. The statues on the arch show Washington as a soldier and as a civilian.

Photos, Ewing Galloway, upper pictures copyright.

erected for The New York Herald. This is one of the most beautiful buildings in the city, if not on the continent. It is copied from a famous Italian palace, but it is now cut up into shops and offices.

A short distance farther north, Broadway leaves room for the office of the New York Times, which is noted for its graceful tower. Every afternoon in summer you can see a crowd of men and boys around these great newspaper buildings to watch the bulletin boards for news of baseball games or races, and on election nights the streets around are so crowded with watchers for the returns that it is almost impossible to force one's way through. Most of the newspaper offices were formerly downtown near the City Hall, on Park Row, which was called "Newspaper Row" and "Printing House Square."

To one of the Broadway crossings the city owes Columbus Circle, where a statue of Columbus stands and also a monument to the dead of the Maine. Round the statue there is a constant roar of city traffic, and it is said that a larger number of wheeled vehicles pass this place than can be found in any other radius of the same size in the world. Beyond Columbus Circle, Broadway is wide enough to have shrubbery in the centre. Near the Cathedral of St. John the Divine it passes the buildings of Columbia University, and in the upper part of the city it is lined with apartment houses in which prosperous people live.

A famous old avenue that continually changes

Fifth Avenue, the dividing line of the city, is difficult to describe. The life of this very beautiful and very famous street is like an abstract of the changing life of the city. Not many years ago it was quite given up to the houses of wealthy people. But business places began to creep in and much of it is now the great shopping district. From Central Park southward, the avenue is wide enough for six motor cars to drive abreast; and in the busy shopping hours the long lines of motor cars and the crowds of moving people on the sidewalk make a picturesque sight. A military parade, when the soldiers march up the avenue in columns of sixteen, between densely packed crowds of eagerly watching people, is a sight which can never be forgotten. On the upper part of the avenue, which runs along the eastern side of the Park, there are handsome houses and great apartments in which many well-known people live.

Where we must go to find the parks of the city

When people who live in New York speak of "The Park" they mean Central Park, an oblong piece of ground about two and a half miles long by nearly half a mile wide, in the heart of the city. In the limits of this small space there are winding roads and paths, rocky places, lakes and woods, fountains and open lawns, tennis courts and playgrounds. It is a beautiful spot, where every advantage has been taken of the natural beauty of the place, and is one of the greatest treasures that the city has in its possession.

Riverside Drive, on the Hudson, is another beautiful city park. On one side there are beautiful private houses and large apartment houses, and on the other side is the river with its ever changing beauty. The older part of the Drive, from Seventy-second Street to the viaduct across the Harlem valley, is the most beautiful. Here, again, the natural beauty of the ground has been made the most of. The broad roadways run under arching trees. Shrubbery has been planted on the sloping ground beside the Hudson, and winding walks lead to beautiful views of the river and the Palisades from many points within the parkway.

The large parks are on the mainland, beyond the Harlem River, or else on Long Island. Van Cortlandt Park is well worth a visit: in it you will see a fine old stone house which was built in the middle of the eighteenth century and also a beautiful sunken garden. There is a good golf course in this park, and tennis courts, baseball grounds and polo grounds where the city people play. The house is a museum for colonial relics. A few miles away, Pelham Park on the Sound makes a fine playground, whither mothers take their children in the summer days. Bronx Park is most loved by the children, for the Botanical Gardens and the Zoölogical Park are there.

Think of all the animals of which you have read in the book of Animal Life and then think of a garden in which nearly all of them are gathered together so that they may be seen in one place, and you

THIRTY YEARS ON FIFTH AVENUE

For many years this reservoir, which was a part of the city water system, stood on Fifth Avenue between Fortieth and Forty-second streets where the Public Library now stands. © Ewing Galloway.

The New York Public Library, on the Astor, Lennox and Tilden foundations, stands on the site shown above. It contains one of the richest collections of books to be found in the United States, besides many manuscripts, pictures and prints. Photo, Ewing Galloway.

This view of Fifth Avenue thirty years ago shows Delmonico's Restaurant, since torn down, on the right beyond the wooden building, which was a famous tavern. © Ewing Galloway.

Fifth Avenue at Fifty-second Street, showing some of the few private homes still resisting the onward march of business in 1925. St. Thomas' Church is on the left. © Ewing Galloway.

have an idea of the Zoölogical Park. There are lions and tigers, wolves and bears, hyenas and jackals, elephants and hippopotamuses; elks and deer lie in the shade in their yards; wild horses and zebras watch us over the fence; a herd of bison wander round a large yard; water fowl swim on the lake, and birds flutter about the large open-air aviary. Of course there are many animals that have to be kept behind iron bars, but as far as possible the animals are allowed during the daytime to go in and out of their houses within their inclosures at will. In the Botanical Gardens are lovely flowers and interesting plants.

In Battery Park, down at the southern end of the city, you will find the Aquarium, where fishes of many kinds swim about in glass tanks, so that you can watch them and study their queer habits. There are a number of smaller parks and a number of public squares in the city, and, indeed, there are few large cities so well supplied as New York with open spaces where trees and flowers grow. Morningside Park is a lovely little uptown park, and a little farther north St. Nicholas Park, on the rocky hillside of Washington Heights, makes a striking foreground for the imposing buildings of the College of the City of New York.

GRANT'S TOMB AND THE SOLDIERS' AND SAILORS' MONUMENT

Of the many monuments in New York, the most beautiful is probably Washington Arch, which stands at the entrance of Washington Square, looking up Fifth Avenue, which makes its beginning here. On the upper side of the arch there are two statues, one of Washington as commander-in-chief of the army, the other of Washington as president.

Grant's Tomb, where General Grant and his wife lie buried, is far up on Riverside Drive at One Hundred and Twenty-fifth Street. It is a square, white granite building in Greek style, as you may see from the picture on page 1041. Thousands of pilgrims come to see it every year—we might almost say every month. It stands on a noble site overlooking the Hudson, and the view of the river from the terrace is very fine. The Soldiers' and Sailors' Monument, on Riverside Drive at Eighty-ninth Street, was built to commemorate the soldiers and sailors of New York who fell in the Civil War. It is also in Greek style, and many people think it more beautiful than Grant's Tomb.

SOME OF THE OLD LANDMARKS OF THE CITY

Although few memorials of the older life of New York have been left, some still remain. Two of the most interesting are the old blockhouse forts, one in Central Park, overlooking One Hundred and Tenth Street, the other on the height of Morningside Park. The Jumel Mansion, which overlooks the Harlem River beyond the great viaduct which crosses the valley at One Hundred and Fifty-fifth Street, was Washington's headquarters after his retreat from New York, and afterward the headquarters of the British army. The house is now a museum for Revolutionary relics and colonial furniture. On Convent Avenue, near the City College, you will find a frame house which was once Alexander Hamilton's country place. Most interesting of all the relics of the old times is Fraunces' Tavern, down near Battery Park, on the corner of Broad and Beaver streets, where Washington made his farewell speech to his officers, when, at the close of the Revolutionary War, he resigned command of the army that he had led to victory.

A FEW OF THE CITY'S MANY CHURCHES, OLD AND NEW

St. Paul's Church, which Washington attended while living in New York, is about half a mile away, up Broadway. St. Paul's is the only church in the city that stands as it did before the Revolution, and it was here that the president and the members of Congress came in solemn procession after the first inauguration. The pew in which he sat is preserved as it was in his time, and so is the pew used by Governor Clinton. General Montgomery was buried in the churchyard just beneath the west window, and his monument is separated from Broadway by only an iron railing and a narrow space. The churchyard is a quiet place, where hundreds of people go every day for a bit of rest.

Trinity Church, on Broadway at the head of Wall Street, is a fine brownstone church built in the Gothic style of architecture. The marble altar is very beautiful. There are some fine windows in the church, and the bronze doors are worth careful study. Alexander Hamilton is buried in the beautiful little churchyard,

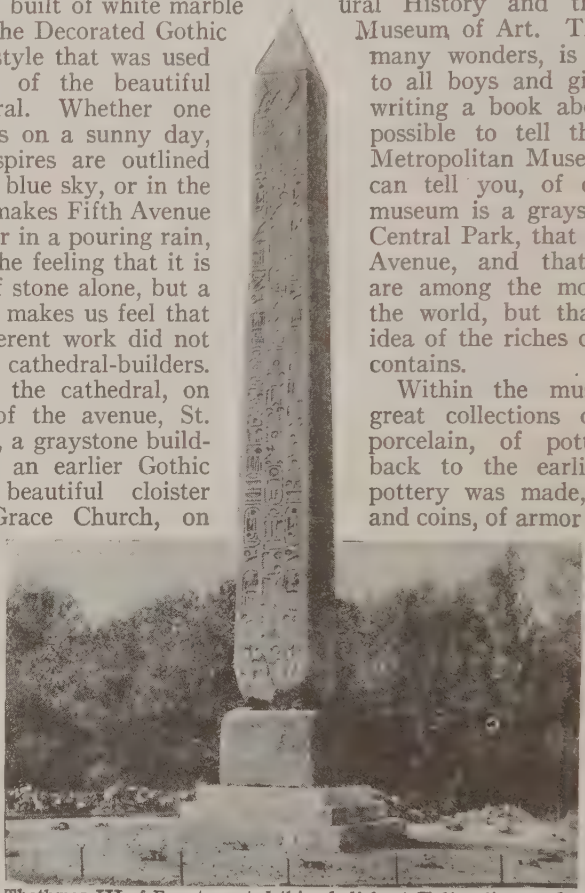
The Museum of the New York Botanical Gardens.

The Hall of Fame and the Library of New York University.

The Metropolitan Museum of Art at Fifth Avenue and Eighty-second Street is one of the great museums of the world. This is only a part of the immense structure which extends up and down the avenue and deep into Central Park. Thousands visit the museum every day. Photos, Ewing Galloway.

and so is Captain Lawrence of the Chesapeake, whose body was brought here from Halifax, where it was first laid.

There are many fine churches in New York, but the one that, after Trinity and St. Paul's, interests us most, is the great Catholic cathedral, St. Patrick's. St. Patrick's Church, which stands on Fifth Avenue between Fifty-first and Fifty-second streets, is built of white marble in what we call the Decorated Gothic style, the same style that was used in the building of the beautiful Rheims Cathedral. Whether one sees St. Patrick's on a sunny day, when its twin spires are outlined against a vividly blue sky, or in the misty light that makes Fifth Avenue most beautiful, or in a pouring rain, it always gives the feeling that it is not a building of stone alone, but a living thing, and makes us feel that the spirit of reverent work did not die with the old cathedral-builders. Within sight of the cathedral, on the other side of the avenue, St. Thomas' Church, a graystone building copied from an earlier Gothic style, has a beautiful cloister at the side. Grace Church, on Broadway near Tenth Street, which is built in the same style as St. Patrick's, gives us something of the same feeling as the larger church. The inside of this church is particularly lovely, and it is much loved by the people of the city.



Thothmes III of Egypt erected this obelisk at Heliopolis, nearly four thousand years ago. It was brought by ship to the United States and set up in Central Park, near the Metropolitan Museum of Art, in 1880–81. Its twin is in London.

The Cathedral of St. John the Divine, the cathedral of the Protestant Episcopal Church, stands on a magnificent cliff-like site and overlooks a large part of the city. It has been in process of construction for over twenty-five years, but is still far from finished. Around the chancel are clustered seven chapels, called the Chapels of the Seven Tongues, in which services will be held in seven different languages. The Cathedral, with its choir school, the hall in which the Synod meets, the Bishop's residence and the Dean's house, with St. Luke's Hospital across the street, and the trees and lawns of Morningside Park below the heights on which they stand, make a splendid picture. You may see views of some of these churches in the story of American architecture.

There are two great museums in Manhattan, the American Museum of Natural History and the Metropolitan Museum of Art. The first, with its many wonders, is very interesting to all boys and girls, but without writing a book about it, it is impossible to tell the story of the Metropolitan Museum of Art. We can tell you, of course, that the museum is a graystone building in Central Park, that it faces on Fifth Avenue, and that its collections are among the most important in the world, but that gives you no idea of the riches of beauty that it contains.

Within the museum there are great collections of furniture, of porcelain, of pottery that goes back to the earliest times when pottery was made, of metal work and coins, of armor from the Middle Ages, of rugs and tapestries, exquisite laces and fine embroideries. If you are interested in the history of ancient Egypt, you can study it from objects that the people used, from pictures that they painted on their tombs, or from parts of the tombs themselves. If you are studying the history of music, you will find a collection of ancient instruments most interesting. There are casts of some of the greatest statues in the world, and models of some of the great buildings of which we have read in this book. Then there are the pictures. You can go through the picture galleries again and again and yet you will not know all the pictures that are in them. By and by you will have your favorites among them,

OPEN SPACES FOR REST AND PLAY

© Ewing Galloway. The Japanese Garden in the Brooklyn Botanic Garden.

© Underwood & Underwood. Bathers at Coney Island on a summer day.

One of the best-loved features of Central Park is the flock of sheep here shown grazing near the western border of the park. Beyond are the apartment houses and hotels on Central Park West. For many years the flock was under the charge of a Scotsman who always wore a plaid. Photo, Kadel & Herbert.

to which you will make little pilgrimages each time that you go, and after a while you will carry these away in your mind, as truly your own as if they hung on the walls of your room. The museum is open every day; and especially on Sunday afternoons and on holidays people throng about the halls.

In Brooklyn there is the Museum of the Brooklyn Institute, which occupies a magnificent new building. There is also a Children's Museum, which was the first to be established in the United States. The Central Museum adjoins the Brooklyn Botanic Garden, which is most interesting. The Native Wild Flower Garden and the Japanese Garden are noted.

The last place of interest to which we shall take you in this great city is the Public Library on Fifth Avenue, the centre of the library system in New York.

© Ewing Galloway.
The Lily Pool in Brooklyn Botanic Garden.

It is a three-story marble building, nearly two blocks in length, built in classic style. A broad flight of steps leads up to the portico over the grand entrance, where bronze doors open into the spacious, high-pillared great hall, and from this a wide flight of stairs leads up into an open gallery on the second floor. The halls are lined with gray marble, and here and there you will find marble benches which might have come from some Roman villa. Within this great building there are a number of reading rooms, which are always filled with students, but the children's library will interest you most of all. This is a charming room, with a warm red brick floor, comfortable low chairs and tables, low bookshelves that any boy or girl can reach, and window-seats in which it is a delight to curl up and read. Of all the libraries in the United States only the Library of Congress has more books, and few in the world are larger. In different parts of the city are many branch libraries from which books may be borrowed for home use. Brooklyn has a library system of its own.

It would interest you to go to some of the city schools, especially in the east side of the city, where many of the children speak English at school and a foreign language to their parents at home, and gradually teach their parents to speak English. There are many huge public high schools and many colleges and universities within the limits of Greater New York. Some of them have a world-wide reputation.

One of the schools that would interest you very much is Cooper Union, an endowed school for the advancement of art and science. It was endowed in 1859 by Peter Cooper as a night school where science and art might be taught free to young people who have to work during the day. Many thousands of people owe their education in painting and designing, in sculpture, in science or mathematics to this famous school. Its night work was found so useful that not very long ago an endowment was made for a day school also. There is a hall in the building where meetings are held, and many famous speeches have been made there by well-known men. Outside the hall there is a statue of Peter Cooper, the founder, made by Augustus St. Gaudens, who received his early training here.

Many miles of railways are needed to carry people from place to place within the city. Some of the railway lines are carried on great elevated structures, some run on the surface of the streets, and others are built underground.

In spite of all the means of traffic the crowding is very great. The difficulty is the shape of Manhattan Island. It is long and very narrow, and the traffic flows up and down. New bridges and tunnels under the rivers reduce the crowding for a little while, but the city grows so fast that conditions are soon as bad as ever.

We have told you of a few of the interesting things about New York. To tell them all would require many large books. It is an interesting city, and offers many opportunities to those who wish to work or to play. Amusement and instruction are equally easy to find.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6333.

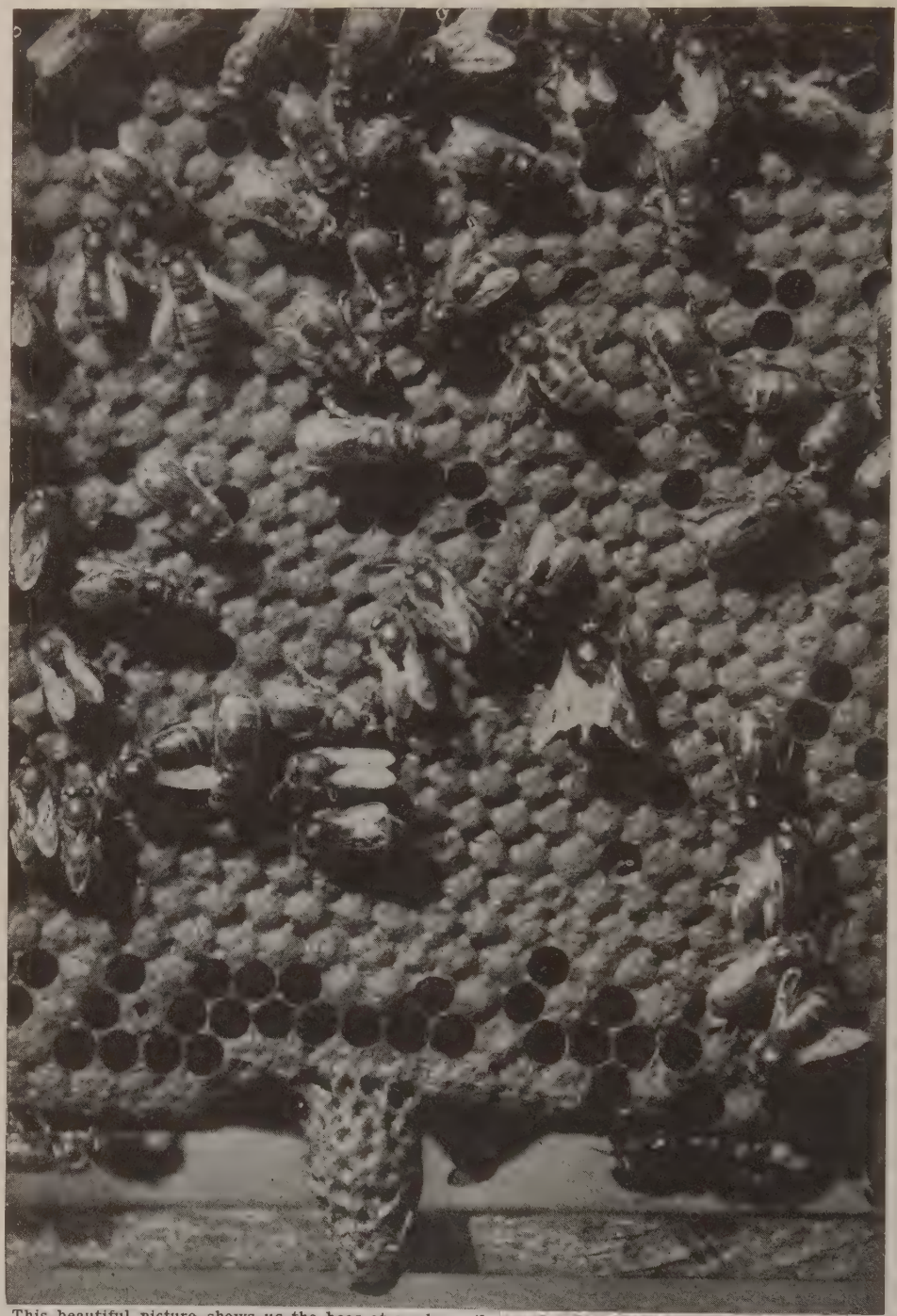
OLD AND NEW IN NEW YORK

Fifty years ago the Park Avenue Hotel was one of the most imposing buildings in the city. It was built by A. T. Stewart, the merchant, to shelter women only, but soon became a regular hotel. Note the bad pavement, horse cars, carriage, the horse-drawn cab and the skirts of the women. © Ewing Galloway.

Park Avenue has become the chief residential street of the city. Note how the upper stories of the Hotel Ambassador are set back from the building-line.
Photo, Ewing Galloway.

The New York Telephone Building far downtown is designed to hold about 6,000 workers. There are 168,000 miles of wire in the building, which is twenty-nine stories above ground and five below.

WHAT WE MIGHT SEE IN THE HIVE



This beautiful picture shows us the bees at work on the comb. Some of them are feeding the baby bees in the cells, some of them filling cells with honey, some of them packing in pollen or "bee bread." Down in front there are some empty cells. Perhaps an egg is in the bottom of each. The irregular pouch hanging from the bottom is a queen-cell, in which a baby queen is living, getting ready to lay thousands of eggs. When she is ready to come out the old queen may lead off a swarm.

Bees making a comb ready for the queen.

BEES AND WASPS

CONTINUED FROM 6078

THE widest literature in the world, next to that of man and his affairs, is the literature of an insect. From the earliest days of learning down to now, poet, philosopher, scientist and common observers have written of the life of the bee. No other creature save man himself has inspired so splendid a tribute.

The reason is twofold. The life of the hive is one of the abiding marvels of nature, an extraordinary civilization much more ancient than our own. Man has observed it because he has dined in the bee's larder since days when he was a wild wanderer on the face of the earth.

Bees were his sole supply of sweetness. Their honey was all he had to sugar his food and drink with. Not until the seventeenth century was old did the product of the sugar-cane reach the poorer people of Britain. Even to the wealthy it was a luxury. For every drink that was sweetened, for every food whose acid sourness was to be made gracious to the palate, the golden honey of the bee was used.

Honey was the forerunner of sugar. It is the standard of sweetness in the Bible, where "sweeter also than honey and the honeycomb" are the judgments of the Lord. Every picture of earthly well-being in days when men walked near God, has honey as one of the principal sources of contentment.

It was a substance in which the Hebrews traded with their neighbors, a delight of the table, a thing to sing songs about.

If we desire further evidence as to the value set on honey we may find it, surprisingly, in a text not of the Bible. It is written upon a tablet of sun-baked clay left by an ancient Babylonian ruler in the long, long ago.

It is an epitaph, written by himself, by an old-time governor, Shamash-resh-usur, and we love him for his claims to the gratitude of posterity. He boasts of no military glory, of no territorial conquest, but believes he is immortalized from the plain fact which he thus sets forth:

Bees, which collect honey, which no man had seen since the time of my fathers and forefathers, nor brought to the land of Sukhi, I brought down from the mountains of the Khabkha tribe, and I put them in the garden of Gabbari-ibni. They collect honey and wax. The preparation

of honey and wax I understand, and the gardeners understand it.

Shamash declared that posterity would ask with wondering reverence of his name and fame: "Is it true that Shamash-resh-usur, governor of Sukhi, brought honey-bees into the land of Sukhi?"

A WEIRD SUPERSTITION ABOUT THE ORIGIN OF THE BEE

We cannot but fancy that Shamash, the pagan Babylonian, knew more of bees than did Samson, who was the first of men known to history to imagine that true bees issued from the body of a dead animal. Insects much resembling bees do still spring from such carrion, but not actual bees. Drone flies, which closely resemble bees, are thought to have deceived Samson as they deceived Virgil and many more recent writers.

Indeed, the old literature of the bee is full of strange error concerning the life-story of these little insect benefactors of man.

Bees were thought not to be naturally born of parents, like other insects, and, if they did not proceed from the decaying body of a dead animal, to originate spontaneously on flowers. Thence they were carried home as tiny babies by adult bees to the hives. Honey was a sort of dew from heaven, collected, not made by the insects.

We may laugh at such superstitions to-day, though the greatest scholars of olden times and of the Middle Ages believed them. Indeed, it was not until Pasteur proved that life cannot arise without parent-life that this error was reluctantly abandoned by modern thinkers.

THE CHILD OF TO-DAY WHO KNOWS MORE THAN VIRGIL KNEW

For two thousand years boys and girls were taught Virgil's story of the life of the bee, most beautiful in language, shrewdly observant of the truth in parts, strangely full of error in others, enshrining all the old foolish notions which he had gathered from the legends of Egypt, and memorable for this lovely thought, that, as he says, bees are inspired with a portion of the soul of the universe:

> Some have said that bees possess a share of the divine mind, and draw the breath of heaven; for they think that the deity moves through all lands and spaces of the sea and deep of heaven; that hence, flocks, herds, men, every kind of wild beasts, each one at birth, derive the delicate spirit of life; and so in course of things are restored to this fountain, and thither return again by dissolution; and there is no room for death, but each flies up into the place of a star, and climbs the height of heaven.

Bees, to Virgil, had no parents, and all thought the hive to be governed by a king of more than natural powers. To-day a child in school may know more of the facts of bee-life than was known by all the great minds which once considered the problem.

And the charm of it all is that the reality is more wonderful than the myth woven by the imaginative old romancers. Let unadorned Truth tell the story.

Bee-keepers of to-day have improved on the natural home of the bee, by providing hives of timber in which are inserted trays bearing frames of wax ready for the bees to build their cells upon, so husbanding the insects' labors and making their yield of honey more abundant. But we will picture the scene within one of the old skep hives in the garden, for there the bees do all the work themselves.

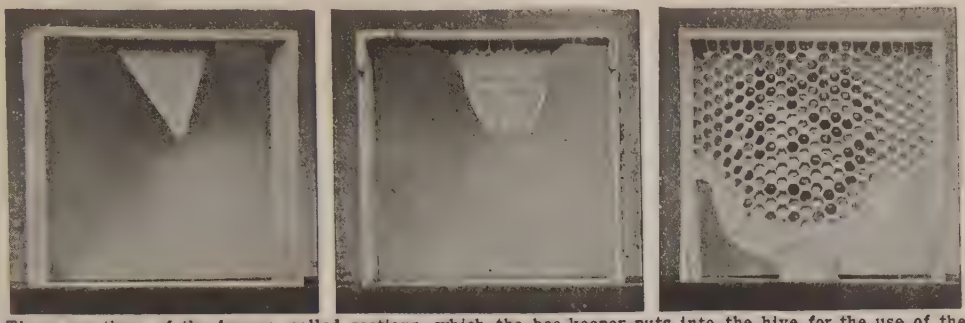
THE MASS OF WORKER BEES WHICH HANGS FROM THE ROOF OF A HIVE

See them placed in, or entering of their own free will, such a skep hive, the queen and her attendant swarm of workers. She is the mother of them all, it may be, and she is urgently impelled by Nature to add to her family. But within the hive all is bare; the interior of a dome of darkness as vast to the bees as the dome of St. Peter's in Rome to a human child.

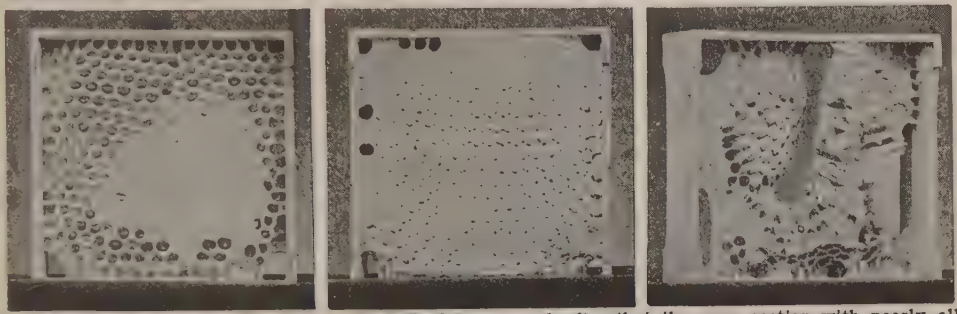
A host of the workers begin at once to clean and garnish the chamber. The remainder hang themselves from the roof of the dome, clinging one to another, so that, as the molecules of a drop of water attached to a solid surface sustain the weight of the whole mass of fluid, so the bees at the top bear the pull of an entire curtain of bees hanging down from the roof almost to the floor.

Thus they hang, hour after hour, practically *thinking wax!* Beneath the edges of the segments of the body of a bee are glands which emit this wax. To do this they must previously have consumed much honey. As the wax slowly makes its appearance it is passed forward to be kneaded and molded by the jaws. The topmost row of bees then press the wax along the roof to form a foundation for the hive. More wax is supplied by the hanging bees below and passed to the builders of the foundation.

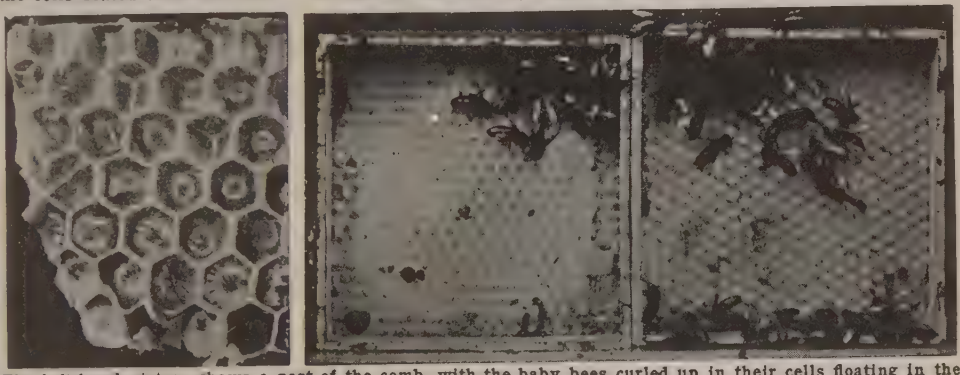
THE WONDERFUL BIRTH OF A BEE



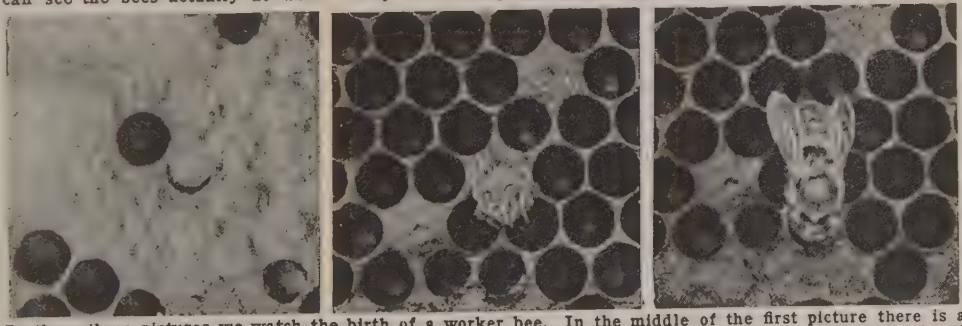
These are three of the frames, called sections, which the bee-keeper puts into the hive for the use of the bees in making the comb. In the first we see the section with the wax foundation ready for the bees. In the second the bees have started building. The third section shows the centre cells filled with honey.



Next we have a frame with all the cells full of honey, and after that the same section with nearly all the cells sealed over with wax. The third is bad work by bees who built their cells without proper wax.



The left-hand picture shows a part of the comb, with the baby bees curled up in their cells floating in the honey, which is to make them big and strong. On the right we are looking down upon two frames and can see the bees actually at work. They are sealing the honey-cells with wax and making all neat.



In these three pictures we watch the birth of a worker bee. In the middle of the first picture there is a half-circle mark, showing where the cell is being opened. Next we see the young bee with its head and half its body free from the cell. In the third picture we see it out of the cell and ready soon to start work.

As soon as this is secured the mass of bees breaks up, and the bees begin to work independently at the building of the comb. Soon a number of six-sided cells are ready, each joining others like itself. At first the cells are all of one size and serve as the homes of the young workers and for storing honey and pollen. After a few weeks larger cells are built for the drones and queens.

THE QUEEN BEE WHICH LAYS THREE THOUSAND EGGS IN A DAY

A young queen at the height of the season (May or June) lays from 2,000 to 3,500 eggs in twenty-four hours. After the second year she lays fewer, but in the course of her four to five years' life she produces many hundred thousand eggs. In the worker-cells and in the queen-cells the queen lays fertilized eggs; but in the drone-cells the eggs are unfertilized. The five or six queen-eggs are not laid simultaneously in the royal cells, but one after another at intervals of one or two days, and the young queens emerge at similar intervals.

Throughout the queen's activities she is waited upon by devoted and respectful attendants who follow her wherever she moves, never turning their backs on her. They feed her, they clean her, they caress her with seeming ecstasy. She is parent, sovereign, all in all to them.

Yet they do not really obey her. They are born to obedience, to observance of a law of which the queen mother is only a living symbol, and only two occasions arise when their will is in conflict with hers.

HOW THE BEES HELP NATURE IN FERTILIZING THE FLOWERS

Then the mastery is with the daughter slaves, not with the royal mother. Let us see what leads to those times.

While the work is proceeding in the hive the workers whose mission it is to go out and forage, fly, day after day, from sunrise to sunset, visiting every flower within range which is not poisonous and which bears nectar and pollen. All in turn are plundered, but only one species at a time. A honeybee collects pollen or nectar on one journey, never both at the same time. There lies a vital value of the bee.

Flowers, to do well, need fertilizing by the pollen of other flowers of their own kind. The bees, clad with many delicate bristles and hair-like processes, become covered with the mealy pollen of the flowers they visit, and, entering flower after flower, leave fragments of that pollen wherever they go. So the fertilization is effected in the exact way that Nature designed.

The pollen, however, is far more abundant than the plants require. Great quantities of it are collected by the bees and stored in little natural panniers, or horny pouches, on their hind legs. The insects bear off such burdens of the pollen for conversion into bee bread that sometimes they cannot reach the hive without resting by the way. As it is received it is placed in cells by other workers, covered with a little honey and sealed up, preserved for future use.

THE WONDERFUL VALVE THAT CONTROLS THE DISPOSAL OF THE NECTAR

The nectar is collected by the bee in two ways. Where the supply is minute the insect can lap up the fluid; but where plenty swells the nectaries of the bloom, the tongue can be fashioned into a pump, and the gracious drops sucked into the first of the bee's two stomachs.

None of the fables tells of a greater wonder than actually exists here. The first stomach is simply a receiver into which the nectar is drawn from the flower. Should she wish, the bee can transfer some or all of it to the second stomach, access to which is given by means of a valve under her control; or the nectar can be returned direct to the mouth to be stored in the cells of the comb.

Thus, when she needs food the bee permits some of the nectar and pollen to pass from the first to the second stomach, where the substances undergo digestive changes as does food when it passes into the stomach of a mammal.

Now, the nursing bees have to feed not only themselves but the larvæ, which are as incapable of assimilating the untreated nectar as human babies are unable to digest the undiluted milk of a cow. The nurses therefore pass the honey and pollen from the first to the second stomach, where, after it has been mixed with digestive juices, it is forced, by way of a special duct, back into the mouth, and is emitted in a thick whitish fluid called bee milk.

Within three days a tiny white maggot has emerged from the egg, and at once demands the attention of several nurses who hasten to fill its cell with bee milk.

The larva not only laps this, but absorbs it through her tender skin. On the fourth day the worker-larva has some honey mixed with her bee milk. After the same period the drones are fed entirely on honey and pollen. But the queen-larvæ, on the other hand, are always fed entirely on bee milk, the royal cells being always flooded with it.

The sole material out of which these vital diets are wrought are the juice and dust of flowers, yet bees juggle accurately with that minute speck of life which comes from the queen mother's egg.

In the hive disciplined wonders are wrought to match these physical marvels. All is as perfectly ordered as in a man-made city, with separate duties for all. There are the queen's attendants, there are the nurses, the servants about the hive who keep the place clean and healthy, carrying out débris like good sanitarians.

Photo, Brown & Dawson.

Before a hive swarms the emigrating bees gorge themselves with honey until they are like the small boy who has eaten too much bread and jam and is too sleepy to play. While they are in this state they seldom sting, and it is quite safe for anyone who does not shrink from them to handle them. Here a girl has thrust her hand fearlessly into the swarm. A swarm can generally be induced to settle in an empty hive by putting it close by, where the scouts can find it, or by putting the queen in it.

THE LITTLE LIVING FANS WHICH KEEP THE HIVE COOL

There are those who tend the weak, and those who collect the bodies of the dead and fly away with them from the hive. Not least astonishing are the ways of those who regulate the temperature of the hive. The busier the bees, the more the heat of their bodies rises, till the hive becomes unhealthily hot. Then the appointed corps of bees whose duty it is, fan for hours with their wings to drive out the heated air and so restore the temperature to its proper level.

The workers have no joy beyond enthusiasm for labor. They have a mother, but no children, no play, no recreation. They begin their toil as soon as they have the strength to stand; they work till their death, which in the summer occurs in about six weeks. Those who last through the winter are of the latest broods of summer.

All the labor, all the refined organization of the hive, is directed to the maintenance of a sufficient supply of live bees in the hive. The queen, after she has taken her wedding flight, returns and never leaves the hive again till she has established an enormous colony of young bees in the cells. As these hatch out they take their turn as nurses in minister-ing to the wants of larvæ still younger than themselves. At the end of two weeks they are strong enough to leave the hive, and then, but not till then, they go forth to bring in food, and wear and work themselves to death.

HOW THE BEE EATS ITS WAY INTO THE WORLD

Now let us peep again into the cell in which an egg is deposited by the queen. In a few days it hatches and a grub floats in a bath of bee milk. As it grows its head reaches the top of the cell, and there it is fed by the working nurses. Two or three times in the course of its career the larva turns upside down, away from the nurses. Each time it does so it casts its skin, molts like a caterpillar.

Finally, like the caterpillar, it reaches a chrysalis stage, spins itself a silken

cocoon, and rests entranced while Nature brings about the great change which transforms it from a grub into a bee. After three weeks the life in the cell is ended: a new bee is about to enter the world.

Its cell is crowned with a mixture of pollen and wax. It must eat its way through. In so doing it feeds itself and gnaws a way to freedom. It comes forth at last, fully clad, but a weak and trembling bee, soft-winged, soft of limbs, incapable of sturdy action for two days. Attendant workers wait upon it, arrange its disheveled-hairs, clean it and offer it honey to eat. Then, as soon as strength has come to it, it hastens to its nursemaid duties, and an older nursemaid is released to fly into the world and rifle flowers while the harvest lasts. It takes about three weeks before a worker bee is strong enough to undertake nectar- or pollen-gathering.

THE ANGRY QUEEN WHO TRIES TO KILL HER DAUGHTERS

Except that they are in larger cells and are differently fed, the development of the males and queens is similar to that of the workers. But the drones are stingless, big and lazy, and have to be assisted to their meals. They do no work. They fly at the appointed time to meet the young queen of other hives. It is their wedding day and their death day, for after their marriage flight they perish.

Once the queen has been mated, the drones are more useless than ever. They are allowed to survive a little while, but in a few days the workers unite to destroy them, either by driving them forth, or by forcing them into an empty comb and starving them to death, or by savagely attacking them with sting and jaws till they are killed.

But now for the royal children, possible queens who may found other families. Quite a different matter is here. The queen, their mother, is an ogress dreadful where they are concerned. She can brook no rival near her throne, not even her own daughters. As they grow up in the cell their voices come to them, and they raise the angry royal pipe. It infuriates their mother, and the fire of battle kindles in her angry heart. She makes toward their cells intending to thrust in her barb and kill them. For the first time her slaves resist her. They will not let her play the murderess—yet.

Wiser than she, they gently but determinedly hustle her away from the royal cells. Now either she must go forth, leading a swarm with her, and leave the hive to a new queen from the cells, or tragedy must follow. If the season be young, the queen goes, and thousands of workers go with her.

NATURE'S MERCIFUL PROVISION FOR THE FUTURE OF THE RACE

Like the Israelites on quitting Egypt, they load themselves with treasure, though this time it is their own and consists only of food. So filled are they with honey that they are almost powerless to sting. Taking advantage of this fact, when we wish to take the honey, we blow smoke on the bees. This alarms them and makes them think of danger and journeys: they load up with honey and become almost harmless to us.

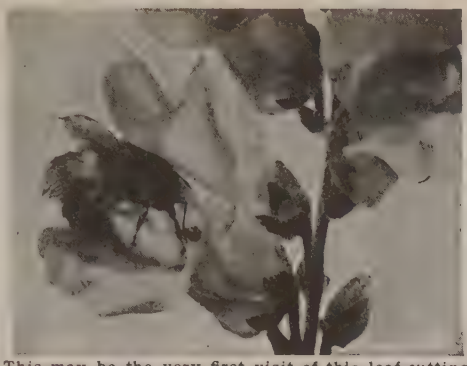
While the queen is waiting to swarm, and the royal children are endeavoring to fight their way out of the cells, the prudent workers pile more and more wax on top of the cells to keep the young aristocrats in. Finally they are permitted to come out, when the queen is gone. If more than one should emerge at the same time, two of them fight.

They know exactly where to plant their stings in order to administer a fatal thrust; but so powerful is the instinct for the preservation of the race, even at the cost of the individual, that if two queens in a death-grapple are both so placed that each can kill the other, they draw apart and manœuvre afresh, so that the fatal wound shall be inflicted by one only, permitting the other to survive and carry on the work of repeopling the hive.

But not every queen can swarm in turn. The time comes when it is inexpedient for more bees to go forth to colonize. Then the workers allow the reigning mother to have her way. She goes from cell to cell, and, with a stab into each, slays all her royal daughters.

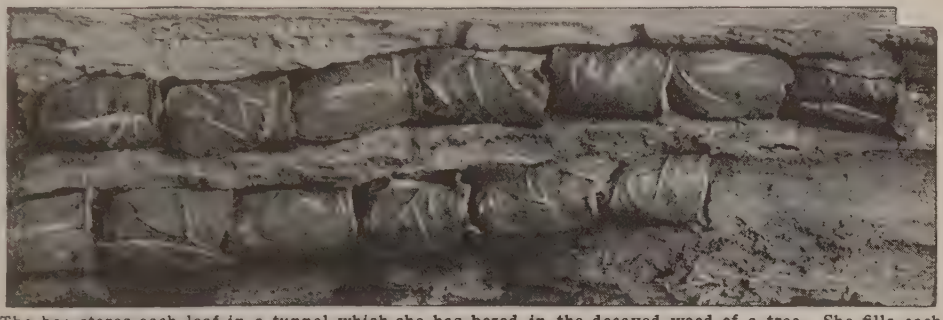
For from four to five years she may rule her children. Then her strength weakens, her flow of eggs begins to fail. In that case the workers either allow a younger queen to come out and put her to death, or they themselves turn in multitudes on her and quietly end her life so that perfect efficiency in reproduction may again reign in the home. For queen, as for humble worker, the rule of life is the continuance of the hive.

A BEE'S CRADLE MADE OF ROSE LEAVES

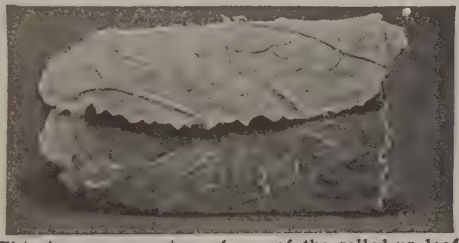


This may be the very first visit of this leaf-cutting bee to a snapdragon flower, but instinct teaches her how to force her way in to extract the honey.

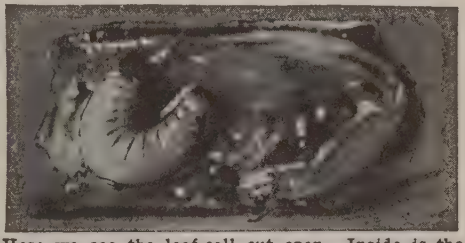
On the other pages we see how swarms of bees work together, but this leaf-cutting bee works alone. Here she is cutting rose leaves for her nest.



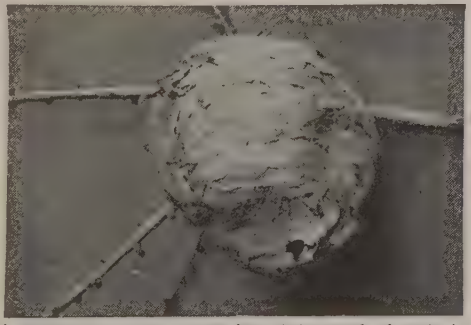
The bee stores each leaf in a tunnel which she has bored in the decayed wood of a tree. She fills each rolled-up leaf with honey and then lays an egg in it. This is a picture of wood cut open to show two such tunnels.



This is a nearer view of one of the rolled-up leaf-cells which we have seen above; it is full of honey.



Here we see the leaf-cell cut open. Inside is the little bee grub eating the honey stored by its mother.



A wasp is a very nasty insect to touch, but it is very clever. British tree wasps build a nest like this. The nest in early summer is like a small plum, but soon it grows to be the size of a football.

Here is a wonderful wasps' nest, cut from an orange tree in Brazil. Made of a substance like stout cardboard, it is really wood-pulp collected and worked up by the wasps. The little black hole is the entrance.

WHY THE BEES ARE AMONG MAN'S MOST VALUABLE ALLIES

In all else the workers are the adoring slaves of the queen; but, as we see, it is a principle that they worship, and she is the living symbol of that principle. So long as she is capable of producing eggs, day and night, throughout the summer, the rest wait on her like human slaves. When she fails, they turn on her and destroy her, or permit her destruction, as we fell a worn-out tree.

In any case the hive must be maintained at a high pitch of excellence. It is in order to get supplies to feed not only the broods and workers, but the hibernating family, throughout the winter, that bees work so hard. It is that which gives them such value to man. He takes their surplus honey, and they, in getting it, fertilize his flowers and fruit trees so thoroughly as to add a considerable amount yearly to the national wealth.

Such machine-like success attends the operations of the average hive that we might despair of human civilization as hopelessly in the rear of this insect economy.

THE TERRIBLE DISEASE WHICH KILLS THE BEES BY SUFFOCATION

But bees have failings just as we have. They blunderingly admit parasites fatal to their lives and fortunes—such little horrors as the larvæ of the oil beetle, which destroy the bee grub in its cell; death's-head moths, which steal the honey; and other troublesome invaders. Moreover, their discipline sometimes breaks down, with appalling results.

One of their deadliest foes is a mite which invades the breathing-tubes of the bees and sets up what is known as the Isle of Wight disease. The bees are killed by suffocation. Nearly all the old English stock was exterminated in recent years by this malady. How came the contagion so widespread? Because from time to time bees forsake the paths of righteousness, and, instead of foraging on their own honest account, turn robbers and pillage the stores contained in weakly defended hives. In such hives lurked the disease, and the conquerors carried back the seeds of death with their spoils.

THE GREAT COMPANY OF INSECTS WITH 40,000 KNOWN SPECIES

Nothing is perfect, even in the system of the honeybee, which is almost the highest yet, beneath that of man himself. Still, with these little flaws, it remains a scheme of wonder far excelling in ascertained fact, the misty miracles ascribed by all the old writers to these splendid little people.

But honeybees are, of course, only one of innumerable sorts of bees. They belong, as a matter of fact, to a company of insects called the *Hymenoptera,* of which we know probably 40,000 species, while there are perhaps four times as many still to be discovered.

The wild bees are as interesting in their way as the citizens of the hives in theirs; but most of them are not social, and do not assemble in great colonies. Notable examples are the Andrena and Halictus, which tunnel little cells for their eggs in sandy soil, though the adults sleep on leaves, not resting, like fly or bird, on their legs, but holding on by their jaws. The Mason Bee molds grains of sand and saliva into a series of perfect cells, and sometimes not only takes possession of holes in gates, posts and doorways, but even blocks up keyholes with these ingenious nurseries.

THE UNDERGROUND NEST OF THE FAMILIAR BUMBLEBEE

The Leaf-cutter Bee is that artist which takes bites out of our foliage, leaving those crescent-shaped gaps which we see in laurel, rose and other leaves. With the stolen parts it forms neat nests, rolling up the pieces of leaf, placing them in hollows or in special burrows, and charging each cell with egg, pollen and honey.

Still more industrious is the Carpenter Bee, which excavates chambers in the stems of plants or in trees, and makes its cradles in a series of these linked nurseries.

Most familiar of all the solitary kinds are the Bumblebees, which dwell in cool and temperate climates. Some make their nests below ground, where one has obtained from a single home combs full of larvæ filling a stable-bucket. Others have their homes above ground, among coarse, close grass and other herbage.

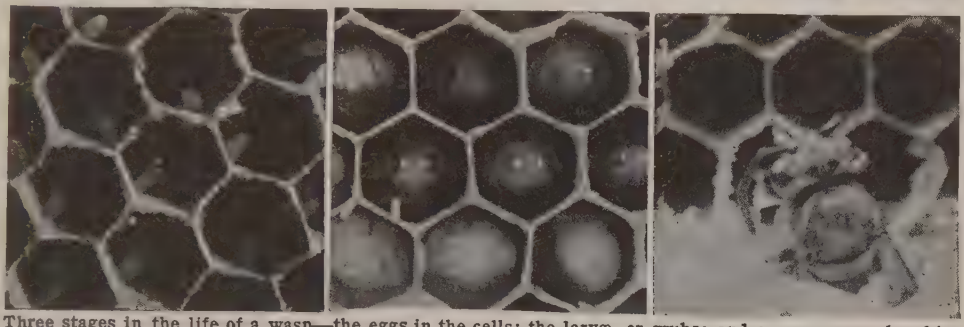
Fierce warriors as they may prove if disturbed, the bumblebees are good friends to us, for they are enormously industrious, perhaps the hardest workers of the entire Bee Family, and their value as fertilizers of clover alone is beyond all calculation. Their short stout bodies and dense hairy covering adapt them for life in cold regions.

BEES, WASPS AND SAWFLIES

Leaf-cutter Bee.

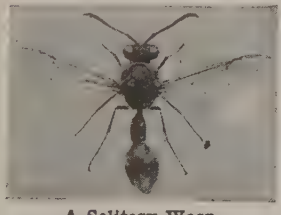
The queen, worker and drone of a Bumblebee.

The Palisade Sawfly.



Three stages in the life of a wasp—the eggs in the cells; the larvæ, or grubs; and a young wasp breaking out of the cell.

Giant Tailed Wasp, or Sirex.



A Solitary Wasp.

A wasp drone.

The drone, queen and worker Hornet.

Orange-colored Sawfly.

Gooseberry Sawfly.

A wasp worker.

THE WASP FAMILY INCLUDES SOLITARY AND SOCIAL SPECIES

Now we must turn to another vast company, the Wasps, which, many in species and habit, may be grouped into two divisions, the solitary and the social kind. They make no honey, they perform no direct service for man; but they are indirectly valuable servants, inasmuch as they kill tremendous numbers of flies and other insects hurtful to us.

Let us at the outset get this matter into figures. It has been found that the inmate workers of a small wasps' nest brought home daily no fewer than two thousand flies, a number which might safely be multiplied by ten or twelve as the season advanced and more lives appeared.

Against this fact we have to remember that wasps do some injury to growing fruit, that they sting us very badly, that they sometimes run amuck for unexplained reasons among horses and cattle, and drive them to madness and death with their stinging barbs.

In practice there is little to choose between the sting of bee and wasp. Both, inflicted on the tongue, may be fatal; both are highly painful and alarming.

In a way, the home of the Social Wasp challenges a respect and admiration second only to that of the bee. We get nothing out of it but stings or a combful of grubs which fishermen use as bait. But the wonder is there none the less.

It lacks the continuity of life proper to the hive, for there is no winter existence. As autumn approaches, the nest disappears. The workers and the drones die. Only the young queens, previously fertilized by the drones, remain. They retire under a roof-edge or in some corner of a shed, seize with their jaws a fragment of straw or rags, and hanging on, wrap their wings around them, and enter on their winter sleep.

In the early spring the queen makes a little hole in some secluded bank; she may even go back to a nest previously used. There she begins a comb, not of wax, but of a sort of paper fashioned from woody fibres which she chews with her jaws into this substance. Here in the cells she lays her eggs, and hunts industriously to bring in food for the grubs as they hatch. When the neuter workers appear they relieve her of her nursing and foraging duties.

THE PAPER NESTS HANGING IN THE BRANCHES OF THE TREES

They bring in food and tend the oncoming generations, and thousands on thousands of wasps appear in a single nest in the course of a hot summer. First come the sexless workers, then the males. They, like the drones of the hive, do no work, but fly forth to meet queens from other nests. The summer and autumn wane, and the combs, now tier below tier, are crowded with grubs not yet mature. But the time has come for all but the mother to die. The last act of the active workers is to kill all that remain unhatched.

The land is left once more to the queens. They alone survive to await the sleep of winter and the advent of a fresh spring.

The Hornet is the largest of our social wasps, an insect one inch in length and armed with a desperate sting. It nests in hollow trees or beneath the eaves of barns, and its brood rarely consists of more than two hundred offspring in the most favorable seasons. Then there is a notable Wall Wasp with us which calmly digs away the mortar of our walls, forms a tube-shaped tunnel and places its egg in it. Other wasps construct great paper nests attached to the branches of trees; some make their homes of mud, of clay, of sand mixed with saliva, and so forth.

The Sphex Wasps catch grasshoppers and crickets, paralyze them, and store them, four to a chamber, in place of honey and pollen for their larvæ.

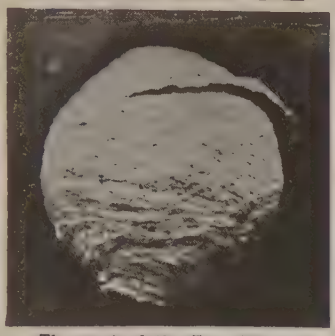
THE TINY GRUB AND ITS BIG STORE OF FOOD

Practically all the wasps leave paralyzed prey for the sustenance of their progeny, but the habit is not entirely to our advantage, for one member of the species captures honeybees and serves them in the same way, five precious bees sacrificed to appease the appetite of each wasp grub.

Wasps undoubtedly possess intelligence, in some respects excelling that of the well-disciplined bee. A bee inclosed in an uncorked bottle whose base is extended toward the light, will beat its head raw trying to fly out of the bottom of the bottle; but the wasp will find its way to freedom through the open neck.

Watchers have noted with delight the extreme pains the wasp takes to learn the

WONDERFUL HOMES OF BEES AND WASPS

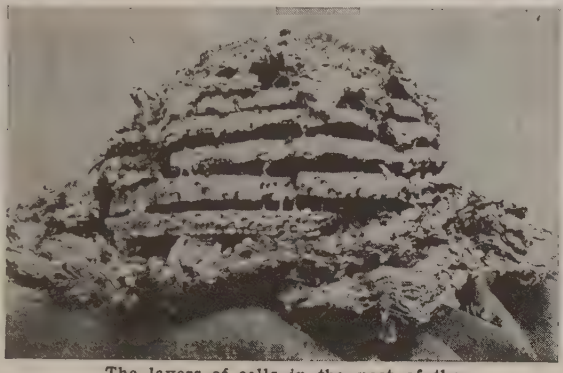


The nest of the Tree Wasp.

The little Gall Wasp.

Nest built by a wasp queen.

Cells of Leaf-cutter Bee in rotten wood.



The layers of cells in the nest of the Common Wasp.

Mud-Wasp cells on a brick wall.

The Sphex Wasp and burrow.

A large swarm of bees.

Entrance to Bumblebee's nest.

A Tree Wasps' nest hidden among the foliage.

Cocoons inside the nest of a Bumblebee.

A Wasps' nest built in a bank.

site of the place in which it has constructed its nest. It does not fly a mile away and then straight back as the outcome of pure instinct. Before departing it flits from point to point, noting landmarks—here a leaf, there a stone and a blade of grass, farther away a whole bush or plant, till everything in the neighborhood has been built up into a memory map. When it comes back from a long hunt bearing a victim, it will drop its prey while it searches out its landmarks. No human airman is more careful in his observations of guide-posts than a wasp.

In addition to these greater wasps which we have been studying, there are innumerable related forms which include one of the most important of groups, the thousands of species of Ichneumon Wasps, called generally Ichneumon Flies. They have the long apparatus at the tail which in the wasps and bees is a sting, but here is only a hollow drill serving to penetrate the body of a victim and thrust down an egg into the wound.

The Little Wasp Which Buries Its Egg in a Caterpillar

To these we owe unstinted gratitude, for the majority of them make caterpillars their living cradles. The idea is horrible, of course, but if it were not practiced by these insects, caterpillars might devour the bulk of our vegetable crops. It is the mission of entomologists to learn more about these useful parasites and encourage their multiplication.

Related to these are those master detectives, the parasitic Gall Wasps, some of which pierce the tough nest of the mason bee, and place an egg in the body of a hidden larva, while others, as the Gouty-legged Wasp, do the same to the larva of beetles living in water. Even more marvelous are the feats of the Egg Wasps, which actually lay their eggs in the eggs of moths and butterflies, and so prevent these from hatching into caterpillars.

Another fascinating company are the true gall wasps, or *Cynipidæ*. Not all the galls observed are produced by these minute wasps, but those on the oaks and the roses are. How the galls arise around the egg and developing larvæ is still something of a mystery. It is fairly clear, however, that the gall does no harm to the tree. As a matter of fact, we benefit, for the finest of the old inks was obtained from the gall nuts of the oak.

Why the Stem Sawfly Is an Enemy of Man

Closely related to these groups are the Sawflies, an important assemblage of insects of which foresters and tree-lovers in general go in dread. Some infect the stems, some the leaves, and some the solid wood of trees and plants to the infinite hurt of the living growth.

The eggs of sawflies are deposited by the parent in the stalks of rye and other grain, and the shoots of our pear and other trees. They live in the grub stage entirely on the substance of the host, and work terrible damage where their numbers are large. Hidden from human eyes, they eat the immature substance of a growth which should become food.

Then there are the great tailed wasps, the giant Sirex, and others, members of the *Siricidæ*, which lay their eggs on pine trees, where their destructive larvæ undergo so long a period of hungry infancy that often they do not complete their cycle of infant life till the tree has been felled, sawed up and built into the fabric or furniture of a house. Then out comes a booming Sirex, probably as startled at its unnatural surroundings as the lawful inmates of the abode at its unexpected and unwelcome appearance.

With the true sawflies we are all more familiar, for they are among the worst pests we have in our beautiful pine woods. The eggs are laid on the leaves or needles of the trees in such numbers that when the larvæ appear the tree seems alive with them; it is colored by their swarming numbers, and its branches are bowed down with the weight of the crawling army of devourers.

How Nature Helps Man by Keeping Down an Enemy

Any child in a garden has seen what havoc little plant-lice can work with roses, killing old growth and preventing new, so we can all imagine the effect on pine trees of teeming swarms of lusty grubs of the sawfly. They are indeed one of the greatest menaces to our timber. Here again we are aided by Nature, for it is known that no fewer than forty species of winged parasites infest the sawfly larvæ; while even the wicked little mice do us a good turn when winds and rains cast down the grubs, or when the larvæ have turned into chrysalises and fallen to the ground.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6349.

A GROUP OF NATURE'S CLEVER CHILDREN

Giant Pompilus Wasp.

Hawthorn Sawfly and cocoon.

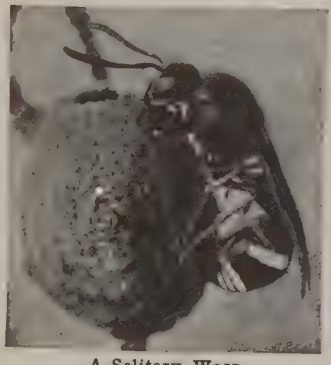
Red-banded Sand Wasp.

Honeybee drone.

Honeybee worker.

Honeybee queen.

The Ichneumon Wasp, a parasitic insect.



A Solitary Wasp and its nest.

Polistes, a Social Wasp, and its nest.

Psithyrus Bumblebees.

The Mason Bee and its nest.

Carpenter Bees.

The pictures on these pages are by Mrs. M. H. Crawford, Messrs. Collins, Hanley, Pike, Ward and others.

A THRILLING THING THAT HAPPENS EVERY DAY

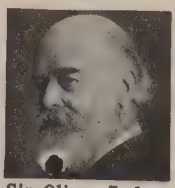
What is the most thrilling thing done by any man every day the earth goes round? We think it is the tap, tap, tapping of a man on the Eiffel Tower, who, at 11 o'clock every night, taps out into space time signals that are heard almost all over the world.

Heinrich Hertz.

Valdemar Poulsen.

Samuel Morse.

Clerk Maxwell.

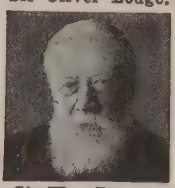

Sir Oliver Lodge.

Carl Steinheil.

Dr. Lee De Forest.

Dr. Graham Bell.

Major Majorana.


Sir Wm. Preece.

THE MAKERS OF TELEGRAPHS, TELEPHONES AND WIRELESS

CONTINUED FROM 6136

NO one can tell us in a sentence who made the telegraphs and telephones. There have been too many men concerned in these inventions for the story to be given in few words. The savage who lights a fire so that the smoke may be seen from afar by his comrades, is using a telegraph such as all men used once upon a time. The army signaler who waves two flags in a particular manner is telegraphing. The man who uses the heliograph—a mirror which reflects the rays of the sun—is using another old-time method of telegraphing signals.

Every boy and girl who has used a piece of looking-glass to reflect the rays of the sun into dark corners has made use of the heliograph without thinking of the wonder that he or she was performing. Boys and girls call the dancing light which they make with their little mirrors a Jack-o-Dandy. It is worth remembering that this sort of thing, on a much greater scale of course, used to serve as a telegraph apparatus for the whole of Algeria nearly a thousand years ago. By an arrangement of large mirrors they used to telegraph with sun rays from one end of the country to the other. We do not know who first thought of using a mirror and the sunshine to telegraph. Many of the most wonderful things in the world were done by men whose names remain unknown.

We do not know for certain the name of the man who first suggested the electric telegraph, which everybody really means now when he talks about the telegraph. Of course, the way of working it is very different from the working of any other telegraph. But we can see that the same forces of nature serve to carry the savage's camp-fire smoke, the reflected rays of the sun and the mysterious electric message which flits along the telegraph wires, or without wires simply through the open air.

The way for the telegraph was being prepared, piece by piece, by those clever, painstaking men who found out about electricity for us. You may read more of these inventors and their experiments in the story, Men Who Found Electricity, on pages 1243 to 1254. They never dreamed to what they were leading. They loved knowledge for its own sake, and little thought of the tremendous gift that they were giving to the world. If we would find the very cradle of the electric telegraph, we ought to seek it in the glass tube from which the jolly Bluecoat boy, Stephen Gray,

sent a current of electricity for a distance of nearly nine hundred feet along a little cable. Sir William Watson did better than this by sending the current from one Leyden jar to another placed two miles away.

THE UNKNOWN MAN WHO WAS THE REAL FATHER OF THE TELEGRAPH

This was interesting, and was wonderful new learning for the scientists. But it did not seem to lead anywhere in particular until, in 1753, an unknown man wrote to a paper in Scotland suggesting that we might use these electric currents for sending *messages* to a distant point.

He had two schemes. One was to have a wire for each letter of the alphabet and to send a current along the wire A when that letter was meant. The current would agitate a piece of paper at the receiving end of the wire, and on that piece of paper would be printed the letter A. Or the current might act upon an automatic inker which would print a sign standing for A, or whatever the letter might be. His second proposal was the better one. That was to have only one wire with a light ball at the end. This ball would be so agitated by the electric current that it would strike a bell and give signals which would stand for letters. The letters could be read off and written down by the person at the receiving end of the telegraph wire.

We do not know who that man was, though some people believe him to have been a Greenock doctor named Charles Morrison. He must have been a man with a very clear mind, for the method of giving the electric signals that is in general use to-day is not very different from the second suggestion that he made.

THE MANY CLEVER MEN WHO PREPARED THE WAY FOR THE TELEGRAPH

But, no matter what had been proposed then, men had not the means to carry it out. They could not produce electricity in sufficient force to make a good telegraph. The discoveries of Volta, giving the world the Voltaic pile, were seized upon as a royal road to success in the new field. Nearly all the men of this period did something to help by their discoveries by placing their knowledge at the disposal of others who were fixing their thoughts on telegraphy. The effects of electricity upon water and upon the salts of minerals, far away as these things seem from an ordinary telegram, all had their share in helping toward the end.

Humphry Davy, the chemist's apprentice, and Michael Faraday, whom Davy helped to success, were among those who did much for telegraphy at this stage by finding out some of the greatest secrets of electricity and its effects. Oersted found that an electric current turns the magnetic needle.

All the world might have known this and have been no better off, had not Faraday, the poor blacksmith's son, worked on and found out that the magnet will electrify wire through which no current is passing. This led him to show us that we can perform wonderful things.

THE FAMOUS DISCOVERY THAT MADE THE ELECTRIC TELEGRAPH POSSIBLE

A great power was thus placed at the command of men. They could create as much electricity as they needed, and could use it as they wanted. There was no fear of its escaping or of the supply's running out, as was bound to happen with the Leyden jar or the Voltaic pile.

Still, the first real telegraph did not come from Faraday's discovery. It was one which cost its maker a great deal of care and money—and disappointment. The inventor was a man named Ronalds, who afterward became Sir Francis Ronalds. The son of a London merchant, he was born in 1788, just when attention was being turned by so many people to the problem of electricity.

When he grew up he gave all his thought to the study, and succeeded in making a telegraph system, with wires eight miles long, in his own garden at Hammersmith. He made the wires run round the garden many times, so that all this length of wire might be employed. Then he had an arrangement for creating electricity by friction, and he could send a current right through the whole length of his wires. At each end he had a dial which, acted upon by the current, caused a letter to appear before an opening in the dial. This arrangement was controlled by the action of a pair of pith balls, through which the current passed.

A BRITISH GOVERNMENT THAT THOUGHT THE TELEGRAPH UNNECESSARY

Having perfected his machine, Ronalds offered it to the British Government, which at that time had only wooden signals worked by hand for their tele-

graphs. But they would not hear of an electric telegraph. "Telegraphs are wholly unnecessary, and no other than the one in use will be employed," they answered. Governments are sometimes very stupid. Ronalds gave up telegraphy, and the field was left to others. Being a cheerful, unselfish man, he rejoiced that others should succeed where he had failed. He saw the telegraph in operation all over the British Isles before he died. The success of the plan is due to Sir Charles Wheatstone and to Sir William Fothergill Cooke.

One of the first men to have an inkling of this great idea was young Charles Wheatstone, who was born at Gloucester in 1802. He was apprenticed to his uncle, a maker and seller of musical instruments. Young Charles, however, showed no special interest in his work and much preferred to read books, so his father took him home and allowed him to follow his natural bent.

THE BOY WHO SAVED HIS PENNIES TO BUY BOOKS

Like many other geniuses, he had a liking for poetry, and not only wrote verses in English, but translated poetry from the French. He also took a great interest in electricity, and saved up all his pennies till he could buy a book on Volta. It was in French, and he found it so difficult that he had to save up more pennies to buy a French dictionary. He mastered the book, however, and started to make an electric battery for himself. Again he had to start saving pennies to buy copper plates. Soon the bright idea occurred to him to use the pennies themselves as copper plates—for at that time pennies were really made of copper, and not, as now, of bronze—and so the battery was made.

A boy with so much determination, willing to save pennies to buy books, and able to use them for a battery, was sure to become famous. At nineteen Wheatstone invented his "enchanted lyre," which was soon exhibited all over London. The enchanted lyre was really a guitar, violin or other musical instrument which was thrown into vibrations when connected with a musical box through a long light rod. As the rod and music box were unseen, the enchanted lyre seemed to give forth music of itself.

The effect of instruments apparently playing by themselves was most uncanny. Once a distinguished musician called on Wheatstone, and in order to amuse the company Wheatstone hung a violoncello in the hall and caused it to play by itself in the usual way. The visitor heard the music, and discovering that it came from a violoncello untouched by a bow, he rushed out of the house and would never enter it again. It is possible that the banjos and guitars that give forth music inside locked cabinets may be made to play in this way.

The whole arrangement, of course, was merely a pretty experiment in the conveyance of sound by solid rods; but it led to many other experiments in the transmission of sound to a distance. Wheatstone even invented a microphone, and believed that a talking machine might be made. His interest, however, was soon transferred to the telegraph, and his chief fame depends on his invention of what is called the five-needle telegraph. Yet he may be said to have started the experiments in transmission of sound which led to the coming of the telephone.

HOW WHEATSTONE AND COOKE MADE THE FIRST PRACTICAL TELEGRAPH

Cooke, who was born in 1806, first heard of electricity in connection with the telegraph while he was studying medicine abroad. His quick mind soon saw that there were great possibilities in it; so, giving himself up to the work, he returned to England and entered into partnership with Wheatstone. The result was excellent. Cooke was a good business man, Wheatstone was a genius. Together they made the first practical telegraph ever used in England. It was first used in 1838, on the London and Blackwall Railway. Like nearly all new things, it was not perfect. It had five lines of wire, which, of course, made it very expensive. In the following year the number of lines was reduced to two, but even this was too costly. In 1845 the partners brought out a telegraph for which only one wire was required. It was practically the same instrument as that used to-day for small offices in the British Isles.

S. F. B. MORSE, THE PAINTER, WHO INVENTED THE TELEGRAPH FOR AMERICA

Other scientists in England, Germany, France and America were working at the same time as Wheatstone in the endeavor to make a telegraph instrument that

would do practical work. Among them, the greatest of all was Samuel Finley Breese Morse, the American. To him we owe not only the famous Morse telegraph system, but the Morse alphabet, which is used the world over in both electric telegraphy and in signaling. You will find this alphabet on page 6052.

Morse was born in Charlestown, Massachusetts, in the year 1791, when Washington was president and when the French Revolution was growing toward fury. His father was a Congregational minister, who was noted for the geographies that he wrote, rather than for his sermons. Samuel Morse grew up in an atmosphere of learning, and graduated from Yale at the age of nineteen. He then became an artist. He was the first president of the National Academy in New York, and went to Europe twice to study.

It was when he was on his voyage back the second time that the incident occurred which turned his attention solely to electricity, in which he had always been interested. The story told is that one day on shipboard, when he was discussing electricity and the electromagnet with other passengers, the idea of his telegraph apparatus came to him. Voyages were slow in those days of sailing ships, and before he reached New York he had worked out the first rough drawings of the instrument which was the forerunner of those now used in most of the countries of the world. He was poor and had to do without many things so that he might use the money for experiments. But he persevered, and by 1836 he had succeeded in making an instrument that would work. The next year he produced a better instrument and showed it to some friends. This was patented the same year, 1837, but it was a long time before Congress would give any help toward building a telegraph line. This they did in 1843. The first telegraph line was built in 1844 from Washington to Baltimore, and Morse sent over it the message "What hath God wrought?"

About ten years afterward a man named Jackson claimed that he was the original inventor of the telegraph. He went to law to prove it, but Morse was able to bring evidence to show that he was the real inventor, and that there was no truth in Jackson's statement.

Morse lived until 1872, and saw the wonderful transformation in the business of the world with which his invention had so much to do. The telegraph was quickly adopted by most of the European countries. Though they paid its inventor nothing at the time, they afterward combined to present him with a large sum.

And now we turn to another American, who was among those who helped to make the Morse telegraph possible. You remember reading on page 1252 that William Sturgeon made the first electromagnet. This was improved upon by Joseph Henry, who insulated the copper wire of the magnet by covering it with silk thread. Instead of using one wire coiled round the magnet, as Sturgeon did, he made a close covering for the soft iron core by winding round it several of his silk-covered wires.

JOSEPH HENRY AND THE ELECTROMAGNET

Joseph Henry was born in Albany in 1797, and attended the Academy there. As he meant to be a doctor, he commenced to study chemistry, and from that his interest in electricity began. In 1826 he was made professor of mathematics in his old school, and shortly thereafter began his experiments with the electromagnet. He made many experiments in electricity which all helped toward gaining knowledge of this wonderful subject.

He was one of the first of the noted scientists in the United States, and was for many years secretary of the Smithsonian Institution, and President of the National Academy of Sciences in Washington. He lived in Washington during the later years of his life and died there in 1878.

Now we must look at the work done in Great Britain by James Clerk Maxwell, who drew much inspiration from Michael Faraday. Maxwell, born in Edinburgh in 1831, was a really mighty man, as delightful as he was great. He was one of those who blossomed early. His father, a widower, made the boy his chief friend and companion.

THE MAN WHO CALCULATED WHAT MUST BE, BUT NEVER FOUND IT

At Cambridge University Maxwell met a young man who had read himself almost blind. He helped the poor man through, at terrible cost to his own health, which suffered a bad breakdown.

THE MEN WHO INVENTED TELEGRAPHS

S. F B. Morse, an American artist, invented the Morse system of telegraphy which has been adopted in almost every part of the world. The first message, "What hath God wrought?" was sent from Washington to Baltimore in 1844. Morse, who is seen here making his experiments, lived for years without recognition, but later he received honors and rewards from many European Governments.

Sir Charles Wheatstone, who did for England what Morse did for America, had an intense love for science from his childhood. He worked in the shop of a music-seller, but found time to study physics, and after many experiments he invented, with Sir William Cooke, the instrument from which has grown the telegraph system in use throughout the British Isles.

Alexander Graham Bell, the inventor of the telephone, with his grandchildren.

However, he won a fellowship at his college and then got in touch with Faraday. That superb son of the forge put into his possession all the knowledge and theories he had of electricity. Maxwell worked at the idea of electrical transmission, carrying out experiments with the simplest apparatus. Then he set to work to develop by mathematics the consequences of his experiments. In his quiet laboratory this young man, by one of the grandest triumphs of the human brain, worked out the idea of the possibility of electrical waves through the atmosphere. He could not find them: apparatus refined enough for their detection did not exist. "But," he said, "they are there, they will be found; and when found, their length will be such and such."

Clerk Maxwell was able to show that the waves of various sizes, even up to a thousand miles long, might be produced; that they would go at one rate in glass and water and at another rate in air; that they would curl round sharp edges and be reflected back, like a ray of light on striking a conductor.

In 1838 a German named Steinheil discovered that the earth itself would carry back the electric current to its starting-place; that it is necessary only to bury the wires in the earth, or "ground" them, in order to complete the circuit. Many discoveries and improvements have been made since then by Stearns, Edison and others, and it is now possible to send eight messages—four each way—over one telegraph wire at the same time. Many improvements have been made in the instruments also, and speed has been raised to almost lightning rapidity. All these improvements, however, are so technical that we have not space to consider them here, and must go on to think of the makers of the submarine telegraph.

Of all the men—and they were many—whose work made the submarine telegraph possible, the greatest was Sir William Thomson, whom we know better as Lord Kelvin. He was born in Belfast in 1824, the son of a professor of mathematics. When only eleven years of age he was received as a student at Glasgow University. He afterward studied at Cambridge University and at Paris, and was a professor in Glasgow University before he was twenty-three. All his life he worked out problems of the most difficult character, as to the strength, action and effects of electric currents under all sorts of conditions.

Lord Kelvin's Work for Submarine and Wireless Telegraphy

To most people it would have seemed dry, unproductive work, but his splendid mind was able to apply to practical uses the discoveries resulting from his delicate experiments and profound calculations. One result was this, that we have those wonderful cables running under the sea to all parts of the world, as we read on page 4293. Bright and Field had the task of laying the cable, but it was the great brain of Kelvin that thought out the instruments which made it possible to record and read the messages. This is only a fragment of what Lord Kelvin did for telegraphy. Some of the most delicate and beautiful portions of his work are employed for the receiving and recording of wireless messages. It will be sufficient, however, for us to remember that, as we grow older, we shall more and more trace the labors of Lord Kelvin, and understand the value of his work for the science of electricity in general, and of telegraphy in particular. Lord Kelvin died on December 17, 1907.

Many improvements have been made in the instruments used in ocean telegraphy, and one of the most important was made by an American army officer, George Owen Squier. By the old method, messages are recorded by a wavy line, which is difficult to read and which cannot be sent quickly. By using the Squier improvement, messages can be recorded by a series of dots. This enables many more messages to be sent within the same period of time.

So far we have considered only the telegraph, but to most of us the telephone is a still more wonderful and beautiful instrument. By its help we can talk to friends who are thousands of miles away.

The Experiments that Led to the First Telephone

The principle of the telephone is explained on page 6183, so that we need not touch upon it again. It is such a marvelous instrument that it seems extraordinary that the idea of it should have occurred to several minds.

But several men did think of it. They thought of it long ago, when, in 1667, Robert Hooke made sound travel, not by electricity, but along a stretched-out wire. They thought of it again when Wheatstone made the sound of a musical box travel along a deal rod from a cellar up into a hall where a large audience was listening. But in 1837, the year that the telegraph was patented in England and America, Dr. C. G. Page, an American, published an essay on the music produced by an electromagnet at the instant when the circuit is closed. That was the beginning of the idea to make electricity the servant of sound.

The Genius who Made the First Musical Telephone

A great step forward was taken in 1860 by Professor Philip Reis, of Friedrichsdorf, who discovered a principle of transmission which was eventually developed

into the musical telephone. Philip Reis was the son of a German master baker and small farmer, and was born at Gelnhausen in 1834. Even when he was a boy of six his teacher recognized that he had remarkable gifts. At the age of ten he was an enthusiastic reader, not only of German, but also of French, English, Latin and Italian books, and was keenly interested in mathematics and science. At sixteen he was obliged to attend classes in mathematics, and physics and natural history, with the intention of becoming a teacher; and in 1858 he succeeded in getting a teaching appointment at Friedrichsdorf. There he investigated the question of the transmission of sound.

In the course of his researches the idea came to him of using a disk, or plate, set into vibration by sound, to make and break an electric current, and of using the current so made and broken to set up similar vibrations in a distant disk, thus reproducing the original sound-waves. The idea had been suggested a few years previously by a Frenchman named Charles Bourseul, but it occurred independently to Reis, and he gave it practical shape. He invented the first telephone to transmit musical notes. He and others who tried to improve his instrument used an intermittent current of electricity. For this reason they failed to make it carry the voice.

THE TELEPHONE IS INVENTED AT LAST

The world waited until 1876. Meanwhile Alexander Graham Bell had prepared an application for a patent that clearly explained both a method and a means for the transmission and reproduction of speech electrically. So clearly worded were application and claims that their validity was upheld by the Patent Office and the courts against all other claimants. Bell's application was filed by his attorney on February 14, 1876. Later that same day a caveat was filed for Elisha Gray, of Highland Park, Illinois.

Elisha Gray was a professional electrician born at Barnesville, Ohio, in 1835. He had invented many electrical devices, including a musical telephone and a multiple telegraph system, both of which won honors at the Centennial Exposition at Philadelphia; and before his death he had obtained over fifty patents for electrical devices. Some of them were very valuable, but none so valuable as the idea of the telephone, which he missed. For the records of the Patent Office show that the idea of a speaking telephone embodied in Gray's caveat was based on an erroneous principle, and that he could not explain how speech could be transmitted electrically until he was taught by the knowledge Bell gave to the world.

ALEXANDER GRAHAM BELL, WHO FINALLY SUCCEEDED

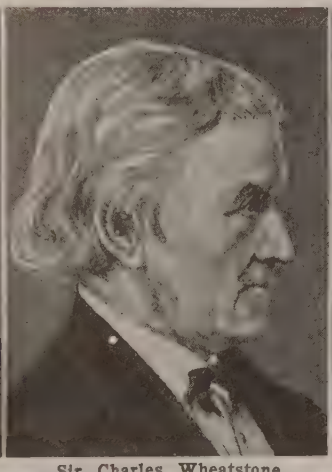
Alexander Graham Bell was born in Edinburgh, Scotland, March 3, 1847. He was taught at home till ten years of age, attended a private school one year, and graduated from the Royal High School shortly after the age of thirteen. From his father and his grandfather he received excellent training in the science and mechanism of speech and in elocution. Previously he had received an exceptionally good musical education from his talented and cultured mother, and later he received supplementary technical training. He was a teacher in a preparatory school when only sixteen years old, and at nineteen was instructor in elocution and correct reading and speaking, and in music, at Somersetshire College, Bath, England. Then he became professional assistant to—and later a partner with—his father in the latter's professional establishment. In 1868 he taught four deaf-born children to speak. Because his health was rapidly failing, the family moved from London to Brantford, Canada, in 1870. Eight months later he went to Boston to teach the teachers in the day school for the deaf how to use the Bell method in more easily teaching the deaf child to speak. In 1872 he established a private training-school for students desiring to qualify as teachers of the Bell method of instruction, and in 1873 he joined the faculty of Boston University. While teaching at Boston he resided in Salem with the grandparent of a deaf-born child he was teaching to speak. In 1874 he applied for citizenship papers, and was always proud of being a citizen of the United States.

His desire to promote the intellectual welfare of deaf children continued throughout his life. He founded and endowed the Volta Bureau and the American Association to Promote the Teaching of Speech to the Deaf. During the five

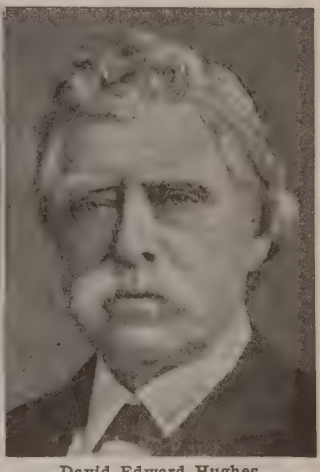
THE PIONEERS OF THE TELEPHONE

Alexander Graham Bell directing the trial of a new kind of kite.

Thomas Edison.



Sir Charles Wheatstone.



David Edward Hughes.

Graham Bell opens the New York to Chicago Telephone Line.

Graham Bell and his wife discuss an experiment.

years preceding his death he was President of Clarke School for the Deaf, Northampton, Massachusetts, and was endeavoring to have a department of research established in the hope of ascertaining the prime causes of deafness, and of perfecting better methods of instructing deaf children.

After he went to Boston he continued to perfect the harmonic multiple telegraph of which he had thought in England, and for which he later obtained a patent. His belief in the possibility of "talking by telegraph" dates from 1866, when he misunderstood that Helmholtz had transmitted and reproduced vowels. If vowels could be transmitted and reproduced, he wondered, why could not consonants, too, be transmitted and reproduced, and, consequently, human speech?

THE DRAMATIC MOMENT THAT GAVE THE TELEPHONE TO THE WORLD

One day while Alexander Graham Bell was working at his telegraph instrument, something happened that caused a sound to travel from the transmitter to the receiver, at which he was listening. That was enough to convince him that he was right in his belief that he could invent an instrument through which the voice could be sent and received. Dropping now his work on his "harmonic telegraph," he patiently set himself at the task of unraveling the mystery of the sound that he had heard. For months he could think of nothing else.

During the summer vacation of 1874, while at the residence of his parents in Brantford, he perfected his conception of a method for the electrical transmission and reproduction of speech, and there invented (mentally) the necessary mechanism consisting of two magneto instruments exactly alike, one to serve as a transmitter, the other as a receiver. But as experimental facilities were not available in Brantford, the official place and date of the birth of the electric-speaking telephone is given as Boston, June 2, 1875.

But Brantford has always claimed the honor of being the birthplace of the invention of the electric-speaking telephone. Alexander Graham Bell indorsed this claim, and also held that the first draft of his application for the fundamental telephone patent was prepared there in 1875, and that in August, 1876, the first public transmission of speech was over a line in which speakers and listeners were several miles apart. Speech had previously been transmitted and reproduced at the Centennial Exposition, but the line was only a few hundred feet in length. In recognition of the originality and importance of his marvelous achievement the city of Brantford erected an artistic granite Bell Telephone Memorial, which the Governor-General of Canada unveiled in 1917.

HOW THE TELEPHONE SURPRISED AN EMPEROR

There is an interesting story about the first public exhibition of the telephone. An instrument was exhibited at the great Centennial Exposition at Philadelphia in 1876, but it attracted little attention. A few people stopped to look carelessly at the "funny thing," but they regarded it as a toy. Even the judges in the electrical section almost passed it by. They came to it at the end of the day, tired and anxious to be gone. If it had not been for the Emperor Pedro of Brazil, they would have gone on. The emperor had once heard Bell give a lesson at a deaf-mute school. He asked about the new invention.

Bell gave him the receiver. "Put it to your ear," he said, and then went to the other end of the wire and spoke into the transmitter. The emperor looked round at the judges. The receiver dropped from his hand. *"It talks!"* was all he could say. Next day Alexander Graham Bell was world-famous.

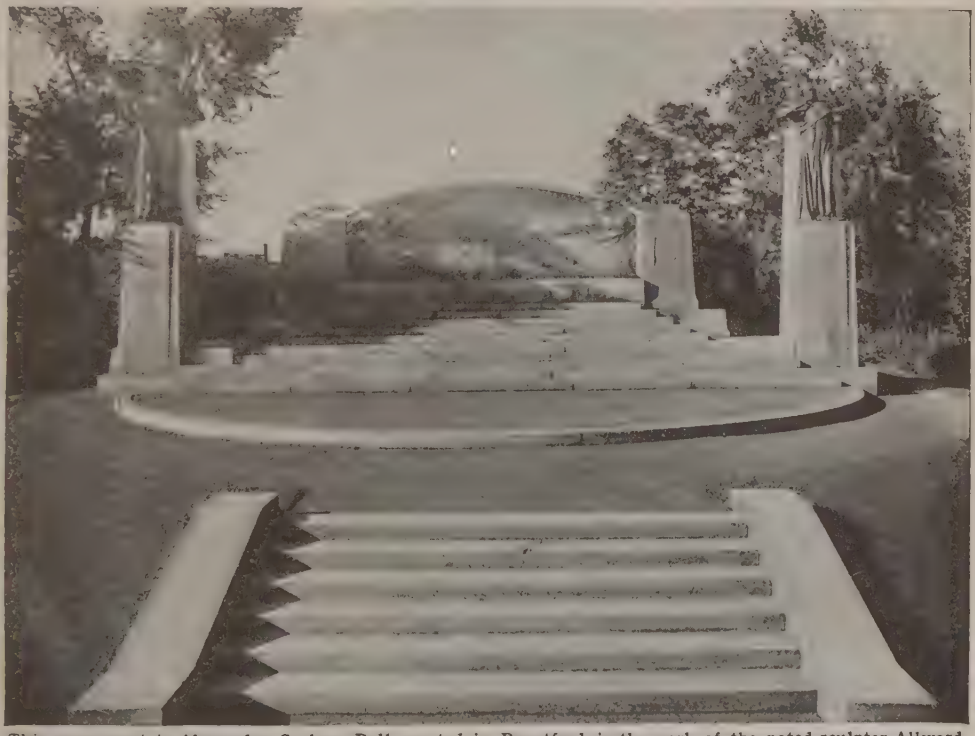
Before his death, in 1922, Alexander Graham Bell made many other inventions. Among these, the telephone probe, has proved of great service to mankind. This instrument enables surgeons to find out where a bullet or fragment of metal has lodged in a man's body, without putting him to the added pain of probing the wound, and has been the means of preventing much pain, if not of saving many lives.

But the modern telephone has a device that neither Gray nor Bell ever used. It has a carbon transmitter called a microphone, which controls the current and is of the greatest importance in the transmission of sounds.

In the carbon microphone, indeed, quite a new principle was introduced, and it is difficult to know to whom credit is due for the discovery. The credit is usually given to David Edward Hughes.

THE BELL HOMESTEAD AND MONUMENT

The Bell Homestead at Tutela Heights, Brantford, where the Bell Telephone was first conceived, 1874.

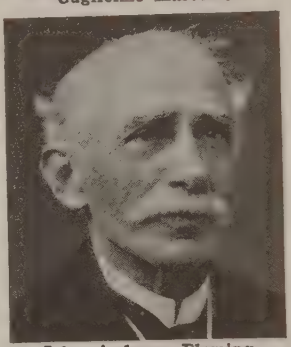


This monument to Alexander Graham Bell, erected in Brantford, is the work of the noted sculptor Allward. It portrays the elusive dream of the inventor's youth—Inspiration whispering to man his power to transmit sound through space. Three floating female figures depict Knowledge, Joy and Sorrow, transmitted to Man by the Telephone. Two heroic figures flanking the flight of steps symbolize Humanity sending and receiving messages.

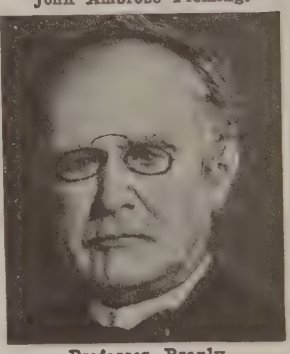
Photos, Walker's Studio, Brantford.

But, as the Frenchman Charles Bourseul seems to have been the first to suggest that a vibrating disk might be used to make and break an electric circuit and throw a distant disk into similar vibrations, so another Frenchman, Du Moncel, seems to have been the first to enunciate the principle that the increase of pressure between two conductors in contact increases their conductivity. That is the principle on which the Hughes microphone transmitter was based. Nor was Hughes even the first to apply this principle. A Frenchman, M. Clerac, of the French Telegraph Service, used it in telegraphy, and lent his instrument to Hughes even before the telephone was invented. In 1877 Edison invented a transmitter dependent on a carbon button exposed to the varying pressure of the transmitter's disk, thus altering the current in time and in proportion to the vibrations.

Guglielmo Marconi.



John Ambrose Fleming.



Professor Branly.

THE MAN WHO DREAMED OF WIRELESS

Like most of the men who took part in the development of the telephone, Hughes was a man of remarkably inventive and ingenious mind. He was born in London in 1831, but when he was only seven his family emigrated to Virginia, and he received his education in Kentucky. He soon displayed great musical talent, and at nineteen he was appointed professor of music at his college. But so great was his interest in science that he also undertook the teaching of natural philosophy. In 1853 he resigned his professorship of music and devoted his whole time to the perfection of a type-printing telegraph. He patented his instrument in 1855, and it was soon almost universally adopted. He settled in England in 1877, and in the following year he patented his carbon microphone. From that date till his death, in 1900, he was engaged in continual research. He seems to have dreamed of the possibility of wireless telephony, and to have anticipated Heinrich Hertz in the discovery of the electric waves, and Professor Branly in the invention of the coherer, which is a remarkably sensitive device for picking up wireless waves.

After Hughes, as a telephone inventor, came Edison, whose patient ingenuity did much to bring the telephone to its present state of perfection. His employment of an induction-coil—a device first used by Elisha Gray—solved one problem of telephoning over long distances.

LONG-DISTANCE TELEPHONING NOW POSSIBLE

When the telephone was first put into use, no one dreamed that within the lifetime of its first inventor a man could speak across the continent from the Atlantic to the Pacific, or could speak in Washington and, by means of the telephone instrument and wireless system, be heard in Paris. That is a wonder at which we never cease to marvel. Perhaps if we realized the amount of deep learning, profound thought and careful, patient work that have gone to bring this about, we would marvel still more. Men of many nations worked on problems which had to be solved, and many inventions were made before the great result could be achieved.

As telephone instruments were made more perfect it was found that they could be used to speak over much greater distances than had at first been thought possible. Still, when the wires were carried beyond a certain point, the sound became indistinct and the result was annoying.

After all the mechanical difficulties had been overcome, it was found that a scientific problem which no one had solved stood in the way of using the telephone over long distances. For a little while this prevented any progress. Before long,

however, the obstacle was overcome by Professor Pupin of Columbia University, who solved the problem and invented a device to overcome the obstacle which it set up.

The honor due for this advance belongs partly to America and partly to little Serbia, for although Michael Idvorsky Pupin was born in Hungary in 1858, his parents belonged to the Serbian nation. He first went to school in his native town, but while he was still very young he was sent to a better school at Prague, in Bohemia. At the age of sixteen he moved to the United States, and nine years afterward he graduated from Columbia University. Later on he studied at Cambridge University in England and at the University of Berlin. When he finished his studies abroad, he came back to America, and has since been engaged in teaching science at Columbia University, in deep study of electricity and in writing.

MARCONI, THE INVENTOR OF WIRELESS TELEGRAPHY

On page 1253 you may read of the discovery of the Hertz, or electric, waves. Now we come to the story of Guglielmo Marconi, the man who learned how to use these waves to send messages round the earth in a moment of time.

Guglielmo Marconi, an Italian whose mother was an Irish woman, was born in Bologna in the year 1874. From childhood he was intensely interested in electricity, and made it his chief subject of study at Bologna University. When he first read of the Hertzian waves, he saw in a flash that they could be used to send messages without the aid of wires. He was astonished that no one had yet discovered how this could be done. Before long he began to make experiments in the garden of his home, with the aid of poles and of simple instruments that he made himself. Very soon, to his unbounded delight, he was able to send messages across the garden.

Then he went to the country to experiment over longer distances. When he succeeded in sending messages a distance of two miles, he offered his discovery to the Italian Government. The Government did not accept his offer, so Marconi wrote to Sir William Preece, the chief of the British Postal Telegraph Service, who invited him to London. He accepted the invitation, and you can judge of Sir William's astonishment when a slim youth of twenty was announced in his office as the scientist Marconi with whom he had been in correspondence.

In England, Marconi went on with his experiments with great success. The English Government took the matter up, and his instruments were installed on a lightship stationed on the Goodwin Sands. A wireless service was established between England and France. Some of the large liners were equipped with Marconi's instruments, a station was built at Poldhu, in Cornwall, and messages flew to and fro between the land and outgoing and incoming ships.

THE SECRET OF MARCONI'S KITE-FLYING

Then Marconi went to Newfoundland to fly kites. Now we have all tried to fly kites, and perhaps you will say, "What a funny thing to do!" But Marconi's kite-flying was done with a purpose. He wanted to prove that messages could be sent across the Atlantic, and he did it. He fastened a receiving instrument to a huge kite. To fly his kite, he used wire fastened securely and attached to an instrument which had a telephone receiver, and by this means he was able, on the cliffs of Newfoundland, to catch a signal sent to him from Poldhu. That was at the end of 1901.

The possibilities of talking by wireless had already begun to fascinate inventors. Professor Simon, of Erlangen, made the astonishing discovery of his talking arc lamp, which later was made to generate wireless waves that would carry human speech through the ether. The wireless arc was soon developed by Valdemar Poulsen, a young engineer on the staff of the Copenhagen telephone service, who had been attracted by wireless since the earliest days.

These early times in the history of the wireless telephone were full of disappointments, for nobody could invent a really successful means of making the voice affect the wireless transmitter. But Poulsen and his colleague, Professor Pedersen, worked out a new means of sending a message by what are known as continuous waves. They succeeded to such an extent that before long they were able to talk by wireless from Berlin to Copenhagen, a distance of 290 miles. Then came something new.

THE SECRET IN THE ELECTRIC BULB, AND HOW IT CAME TO BE USED

The years 1906 to 1908 were great ones for the new telephony. Fessenden, a Philadelphia professor, succeeded in sending the voice over a distance of two hundred miles between Brant Rock and New York. A little later a countryman of Marconi, Major Majorana, was able to telephone from Rome to Sicily.

The achievement of Majorana, a really famous pioneer of the wireless telephone, brings us to the great discovery of the valve invented by John Ambrose Fleming. Professor Fleming had already given a great deal of practical help to Marconi in designing the early stations with which long-distance experiments had been carried out. He had invented a way of measuring the length of the waves that flash through the ether with the speed of light. He now discovered the wonderful secret that the stream of electrons shot out by the incandescent filament of an electric lamp offer a path for the tiny currents picked up by a wireless receiving instrument. By fixing a little plate of metal into an ordinary electric bulb he made wireless currents flow from filament to plate, and thus give a buzz in the telephone.

Then began that extraordinary march of events which rapidly swept away the difficulties of talking by wireless. From being a mere *detector* of wireless signals, the valve soon became a new force by which the strength of these feeble stirrings of electricity could be greatly magnified.

THE WONDERFUL VALVE THAT CHANGED THE FACE OF WIRELESS

While Dr. Fleming was making his important discoveries in his laboratory at University College, London, a man was working in the Chicago laboratory of the Western Electric Company, where a spark was being made with some apparatus worked by pulling a piece of string. This man, Dr. Lee De Forest, noticed that every time he pulled the string and closed a switch the light from a gas mantle in the room increased perceptibly. He had discovered that heated gas molecules were sensitive to electric waves. By a brilliant series of experiments, using an electric lamp as Professor Fleming had done, he found that by putting inside the lamp what he called a "grid," as well as a plate, it was possible greatly to magnify the wireless signals. He had discovered the "speaking jinn in the glass bottle," the modern valve in use to-day. There are dozens of other men who have had a part in making radio what it is to-day, but we shall mention only two, Dr. Irving Langmuir and Major E. H. Armstrong, though it is difficult to describe their work except in technical language.

Within a few years a real craze for radio began. Instruments at a reasonable price were put upon the market, and in city, village and country thousands were set up. Great broadcasting stations were built, and every day send out into the ether elaborate programmes, planned both to amuse and to instruct. The possibilities of this new force are not yet realized, and the effect it will have upon life in town and country is the subject of much wonder and speculation.

THE WONDROUS FIELD IN WHICH NEW DISCOVERIES ARE FOREVER MADE

Among the many brilliant names of the wireless pioneers two others will stand out for all time as having helped greatly in making navigation safer. They are Bellini and Tosi, the inventors of the wireless compass, which has since been so marvelously developed by Marconi. Henceforth the names of men distinguished for their work in the wireless wonder world will be very numerous, for the field is so wide, and of such immense importance to mankind, that new experiments and fresh discoveries are constantly being made.

But to Marconi alone belongs the honor of seeing the one way in which messages could be sent without the use of wires. All the others have followed in the pathway that he showed.

Like Professor Bell, he has lived to see the greatness of his work appreciated by the world. Many honors have been given to him, but probably nothing has ever brought him greater triumph than he felt when he heard the first faint signal caught and recorded by his first little instrument, and knew that he, a boy of nineteen, had mastered one of the greatest powers of nature. He has had much happiness in his life, but nothing can have given him purer joy than the knowledge that his discovery has been the means of saving thousands of lives.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6325.

POLITICAL AND NATIONAL SONGS

MUSIC and song are the expression of emotion and feeling, and nowhere is this more apparent than in the history of the patriotic songs of different peoples. A nation is not obliged to have a national song, as it is to have a settled form of government and laws for the state. But in some crisis of national life a song arises which embodies the sentiments of the hour and, because it satisfies this need for expression of a whole people, it endures, and in time becomes a national hymn. Sometimes it is the music which possesses popular fancy; sometimes it is the words. In other parts of our book you will find much British, French and Canadian patriotic poetry. We have given place in this section to countries not so well represented, including the national songs of the United States. The history of The Star-Spangled Banner is on page 6512. The national songs of Austria, Holland, Denmark, Italy, Finland, Norway, Rumania and Sweden, included in this section, are taken from Airs of All Lands, by John Philip Sousa, by permission of Carl Fischer, publisher.

THE STAR-SPANGLED BANNER

CONTINUED FROM 6113

O SAY, can you see, by the dawn's early light,
What so proudly we hailed at the twilight's last gleaming?
Whose broad stripes and bright stars, through the perilous fight,
O'er the ramparts we watched, were so gallantly streaming!
And the rocket's red glare, the bombs bursting in air,
Gave proof through the night that our flag was still there:
O say, does that star-spangled banner yet wave
O'er the land of the free and the home of the brave?

On the shore, dimly seen through the mists of the deep,
Where the foe's haughty host in dread silence reposes,
What is that which the breeze, o'er the towering steep,
As it fitfully blows, now conceals, now discloses?
Now it catches the gleam of the morning's first beam,
In full glory reflected now shines on the stream:
'Tis the star-spangled banner! O long may it wave,
O'er the land of the free and the home of the brave!

And where is that band who so vauntingly swore
That the havoc of war and the battle's confusion
A home and a country should leave us no more?
Their blood has washed out their foul footsteps' pollution.
No refuge could save the hireling and slave
From the terror of flight, or the gloom of the grave:
And the star-spangled banner in triumph doth wave
O'er the land of the free and the home of the brave.

Oh! thus be it ever, when freemen shall stand
Between their loved homes and war's desolation!
Blest with victory and peace, may the Heav'n-rescued land
Praise the Power that hath made and preserved us a nation.
Then conquer we must, for our cause it is just,
And this be our motto: "In God is our trust."
And the star-spangled banner in triumph shall wave,
O'er the land of the free and the home of the brave.

COLUMBIA, THE GEM OF THE OCEAN

Although Christopher Columbus discovered the West Indies, and never set foot upon the mainland of America, it was at first proposed to call this new land "Columbia." Some of the patriotic songs refer to the country by this name. This song was written by Thomas à Becket in 1843, and Hail Columbia by Joseph Hopkinson, a young lawyer, in 1798. It was suggested by David T. Shaw.

OH, Columbia, the gem of the ocean,
The home of the brave and the free,
The shrine of each patriot's devotion,
The world offers homage to thee.
Thy mandates make heroes assemble,
When Liberty's form stands in view;
Thy banners make tyranny tremble,
When borne by the red, white and blue,
Thy banners make tyranny tremble,
When borne by the red, white and blue.

When war winged its wide desolation,
And threatened the land to deform,
The ark then of Freedom's foundation,
Columbia, rode safe thro' the storm:
With the garlands of vict'ry around her,
When so proudly she bore her brave crew,
With her flag proudly floating before her,
The boast of the red, white and blue,
With her flag proudly floating before her,
The boast of the red, white and blue.

The star-spangled banner bring hither,
O'er Columbia's true sons let it wave;
May the wreaths they have won never wither,
Nor its stars cease to shine on the brave.
May the service united ne'er sever,
But hold to their colors true;
The army and navy forever,
Three cheers for the red, white and blue!
The army and navy forever,
Three cheers for the red, white and blue!

YANKEE DOODLE

Yankee Doodle has been called "the nursery rhyme of the American army." It is difficult to account for its popularity, but it cheered the ragged soldiers of the Revolution, and has lived in spite of all efforts to replace it with words more appropriate.

FATHER and I went down to camp,
Along with Captain Goodin',
And there we saw the men and boys,
As thick as hasty puddin'.

Chorus

Yankee Doodle, keep it up,
Yankee Doodle dandy,
Mind the music and the step,
And with the girls be handy.

And there we see a thousand men,
As rich as Squire David;
And what they wasted ev'ry day,
I wish it could be savèd.

The 'lasses they eat ev'ry day,
Would keep a house a winter;
They have so much that, I'll be bound,
They eat it when they've mind to.

And there I see a swamping gun,
Large as a log of maple,
Upon a mighty little cart;
A load for father's cattle.

The troopers, they would gallop up,
And fire right in our faces;
It scared me almost half to death
To see them run such races.

It scared me so I hoofed it off,
Nor stopped, as I remember,
Nor turned about till I got home,
Locked up in mother's chamber.

DIXIE

There are many versions of Dixie, usually absolute nonsense, but this particular one shows how intensely Southerners felt at the time of the Civil War. Happily all are now welded together as one country, united in loyalty and devotion to the nation.

SOUTHRONS, hear your country call you!
Up, lest worse than death befall you!
To arms! To arms! To arms, in Dixie!
Lo! all the beacon-fires are lighted,—
Let all hearts be now united!
To arms! To arms! To arms, in Dixie!
Advance the flag of Dixie!
Hurrah! hurrah!
For Dixie's land we take our stand,
And live or die for Dixie!

To arms! To arms!
And conquer peace for Dixie!
To arms! To arms!
And conquer peace for Dixie!

Hear the Northern thunders mutter!
Northern flags in South winds flutter!
Send them back your fierce defiance!
Stamp upon the accursed alliance!

Fear no danger! Shun no labor!
Lift up rifle, pike and sabre!
Shoulder pressing close to shoulder,
Let the odds make each heart bolder!

How the South's great heart rejoices
At your cannons' ringing voices!
For faith betrayed, and pledges broken,
Wrongs inflicted, insults spoken.

Strong as lions, swift as eagles,
Back to their kennels hunt these beagles!
Cut the unequal bonds asunder!
Let them hence each other plunder!

Swear upon your country's altar
Never to submit or falter,
Till the spoilers are defeated,
Till the Lord's work is completed.

Halt not till our Federation
Secures among earth's powers its station!
Then at peace, and crowned with glory,
Hear your children tell the story!

If the loved ones weep in sadness,
Victory soon shall bring them gladness,—
To arms! To arms! To arms, in Dixie!
Exultant pride soon banish sorrow,
Smiles chase tears away to-morrow.
To arms! To arms! To arms, in Dixie!
Advance the flag of Dixie!
Hurrah! hurrah!
For Dixie's land we take our stand,
And live or die for Dixie!

To arms! To arms!
And conquer peace for Dixie!
To arms! To arms!
And conquer peace for Dixie!

MY COUNTRY, 'TIS OF THEE

This song, written in 1832, by an American Baptist clergyman named Samuel Francis Smith, has long been regarded as the national hymn of the American people, breathing, as it does, the spirit of liberty which the government of the country offers to its citizens and to the thousands from other lands.

MY country, 'tis of thee,
Sweet land of liberty,
Of thee I sing;
Land where my fathers died,
Land of the Pilgrims' pride,
From every mountain side
Let freedom ring.

My native country, thee—
Land of the noble free—
Thy name I love;
I love thy rocks and rills,
Thy woods and templed hills;
My heart with rapture thrills
Like that above.

Let music swell the breeze,
And ring from all the trees
Sweet freedom's song:
Let mortal tongues awake;
Let all that breath partake;
Let rocks their silence break—
The sound prolong.

Our fathers' God, to Thee,
Author of liberty,
To Thee we sing:
Long may our land be bright
With freedom's holy light,
Protect us by Thy might,
Great God, our King.

BATTLE-HYMN OF THE REPUBLIC

Mrs. Julia Ward Howe, who died in 1910, in her ninety-second year, may be described as one of the most eminent women of America. She won fame both as a writer and as a speaker, and wrote many books. She will be remembered chiefly for this celebrated poem, written in the early days of the Civil War, to encourage the soldiers of the North in fighting for the preservation of the Union.

MINE eyes have seen the glory of the coming of the Lord;
He is tramping out the vintage where the grapes of wrath are stored;
He hath loosed the fateful lightning of His terrible swift sword;
His truth is marching on.

I have seen Him in the watch-fires of a hundred circling camps;
They have builded Him an altar in the evening dews and damps;
I can read His righteous sentence by the dim and flaring lamps;
His day is marching on.

I have read a fiery gospel writ in burnished rows of steel:
"As ye deal with my contemners, so with you my grace shall deal;
Let the Hero, born of woman, crush the serpent with his heel,
Since God is marching on."

He hath sounded forth the trumpet that shall never call retreat;
He is sifting out the hearts of men before His judgment-seat:
Oh, be swift, my soul, to answer Him! Be jubilant, my feet!
Our God is marching on.

In the beauty of the lilies Christ was born across the sea,
With a glory in His bosom that transfigures you and me:
As He died to make men holy, let us die to make men free,
While God is marching on.

AMERICA, THE BEAUTIFUL

This very beautiful hymn, written by Katharine Lee Bates, expresses the vision which all high-hearted men have dreamed. The first stanza is unequaled in the picture which it presents in four lines.

O BEAUTIFUL for spacious skies,
For amber waves of grain,
For purple mountain majesties
Above the fruited plain!
America! America!
God shed his grace on thee,
And crown thy good with brotherhood
From sea to shining sea!

O beautiful for pilgrim feet,
Whose stern, impassioned stress
A thoroughfare for freedom beat
Across the wilderness!
America! America!
God mend thine every flaw,
Confirm thy soul in self-control,
Thy liberty in law!

O beautiful for glorious tale
Of liberating strife,
When valiantly for man's avail,
Men lavished precious life!
America! America!
May God thy gold refine,
Till all success be nobleness,
And every gain divine!

O beautiful for patriot dream
That sees beyond the years
Thine alabaster cities gleam
Undimmed by human tears!
America! America!
God shed his grace on thee,
And crown thy good with brotherhood
From sea to shining sea!

AUSTRIA

The story runs that during his visit to London Haydn was so stirred by the strains of God Save the King that on his return to Vienna he composed a national anthem on similar lines for his own country. This hymn was first sung in 1797.

GOD preserve our noble Emp'ror,
Franz our Emp'ror good and great!
Mighty ruler! high in wisdom,
We his glory celebrate!
Love shall twine him laurel garlands,
They become his regal state!
God preserve our noble Emp'ror,
Franz our Emp'ror good and great!

Over blooming lands his sceptre
Doth extend both wide and far;
Of his throne the noblest pillars
Righteousness and mercy are.
Over all his shield extended
Beams effulgent as a star.

To array himself in virtue,
Ever was his constant care;
Only to defend his people
Doth his sword flame high in air.
In their blessings thus rewarded,
He finds all his pleasures there.

Bonds of slavery he has broken,
He has made his people free,
He of knighthood is the flower,
Brave and good and true is he;
And when comes his latest hour,
May he by angels greeted be.

HOLLAND
WIEN NEERLANSCH

These verses were written in 1815 by the Dutch poet Hendrik Van Tollens and set to music by Smits in 1820, since when it has been the national song of the country.

LET him in whom Dutch blood flows,
Untainted, free and strong,
Whose heart for Prince and country glows,
Now join us in our song;
Let him with us lift up his voice,
And sing in patriot band,
The song at which all hearts rejoice,
For Prince and Fatherland!

We brothers, true unto a man,
Will sing the old song yet;
Away with him who ever can
His Prince or land forget!
A human heart glowed in him ne'er,
We turn from him our hand,
Who callous hears the song and pray'r
For Prince and Fatherland!

Preserve, O God, the dear old ground
Thou to our fathers gave;
The land where we a cradle found
And where we'll find a grave!
We call, O Lord, to Thee on high,
As near death's door we stand.
Oh! safety, blessing, is our cry,
For Prince and Fatherland.

Loud ring thro' all rejoicing here,
Our pray'r, O Lord, to Thee;
Preserve our Prince, his House, so dear
To Holland, great and free!
From youth thro' life be this our song,
Till near to death we stand!
O God, preserve our sov'reign long,
Our Prince and Fatherland.

DENMARK
KONG CHRISTIAN STOD VED HIERN MAST

The melody is of ancient origin and the author unknown. Since about 1775 it has been regarded as the national song of Denmark. The verses recall, and sing praises of, various Danish heroes.

KING CHRISTIAN stood beside the mast
In smoke and mist;
His glitt'ring sword was swinging fast,
Thro' hostile heads it swiftly passed,
Then sank each Gothic hulk and mast
In smoke and mist.
Fly! shouted they, for no man can
The power of Denmark's Christian
Resist!

Nils Juel heard the tempest high,
'Tis now the hour!
He raised the red flag t'ward the sky,
And smote the foe till all did cry
Aloud above the tempest high,
'Tis now the hour!
Fly! called they, who his life would save!
Of Denmark's Juel who can brave
The pow'r?

North Sea! a glimpse of Wessel brake
Thy low'ring sky!
Thy knights are fighting for thy sake,
Within the sea foes refuge take,
A cry of wild despair doth break
Thy low'ring sky!
Fly! shouted they, even warriors bold
From Denmark thunders Torkenskiold,
Then fly!

Path of the Dane to fame and pow'r,
Dark-rolling flood!
Receive the friend who ne'er did cow'r
Before grim death in danger's hour,
But braves, as thou, the tempest's pow'r,
Dark-rolling flood!
Thy wat'ry arms my graves shall be!
Receive in war and victory
My blood!

ITALY
GARIBALDI'S HYMN

Italy has two national airs: The Marche Royale and Garibaldi's War Hymn, but the March has no words. This hymn was written in 1859 by Mercantini, and the music is attributed to Olivieri.

FROM out the tomb the dead heroes are speaking,
Martyrs of old retribution are seeking,
Their swords now at rest, 'round each head shines a halo,
With Italy's motto engraved on each breast,
Come forward all, come forward!
Rise, comrades, brave and glorious,
Unfurl the banner for we'll be victorious,
We'll give our foe the sword and likewise the dreaded fire-brand,
For we must conquer, 'tis Italy's command.
So fight with the sword,
So fight with the sword,
With fire and sword,
With fire and sword.

FINLAND
VART LAND

The words of Finland's national song are from the pen of the poet Runeberg and the music by Frederick Pacius, a pupil of Spohr. There are eleven verses, of which the first only is given here.

OUR land, our land, our Fatherland!
Thou glorious word, ring forth!
No mountain rises proud and grand,
Nor slopes a vale, nor sweeps a strand,
More dear than thou, land of the North,
Our fathers' native earth.

NORWAY
SONNER AF NORGE

These verses, which show a distinct leaning for democracy, were written by H. A. Bjerregaard, and were set to music by C. Blom about fifty years ago.

SONS of dear Norway, O proud and ancient kingdom,
Sing to the harp in a jubilant song!
Proudly exult in possession of freedom,
Honor your land, to which honors belong,
Glory bestowing,
Patriots showing,
How to be worthy the fatherland dear,
Throbbing our hearts and our faces glowing,
Singing of freedom in melody clear.

Land of great mountains, snow-peaked, cloud-capped and rugged,
Vales rich and fertile and seas filled with fish!
Now and for all time, thy people love thee dearly,
Would die for thy sake, if 'tis thy royal wish.
Dearest of mothers,
We stand as brothers,
Pledged to defend thee for liberty's sake,
Grow, grand old nation, surpassing all others,
Until the waves on thy shores cease to break.

BELGIUM
LA BRABANÇONNE

This song appeared in 1830, during the war between Belgium and Holland, when the Belgians wanted to be released from Dutch rule. The verses were written by Jenneval, and set to music by François Van Campenhout. This is a recent translation.

LONG years of bondage having ended,
The Belgian, rising from his shame,
Regains at last by courage splendid
His flag, his rights and ancient name.
And thy hand, supreme and glorious
That nations of the earth may see,
Shall write on thy flag victorious
"The King, the Law, and Liberty!"

March on, then, with shoulder to shoulder,
March on, then, from progress to progress.
God sees thy courage growing bolder
And smiles at thy virile success.
Let us work! May our efforts render
To our fields due fertility;
And let the arts crown with their splendor
The King, the Law, and Liberty.

Let us open our ranks, forgetting
Old feuds with foemen we have known;
Ere our Life's sun sinks to its setting
All Dutchmen as brothers we'll own.
Let us hold out the hand in greeting,
And may truth and fraternity
Inspire our song while Time is fleeting:
"The King, the Law, and Liberty."

Oh, Belgium, Mother, may we ever
Devote our hearts and arms to thee;
God grant thy future sons may never
Forget thee in the days to be.
Thou shalt live ever great and splendid,
In bonds of lasting unity.
And thy watchword till Time be ended,
"The King, the Law, and Liberty!"

RUMANIA
TRACASCA REGELE

In 1861 the government of Rumania offered a prize for the best national hymn. This is the hymn which won the prize, and was adopted by the Rumanian army, January 22, 1862.

LONG live the King in peace,
Long may his pow'r increase,
Long may he reign o'er us,
Shout we loud the chorus.
Ruler grand, thy glorious land
Predicts success for thee,
Evermore, in peace or war,
Great King triumphant be.
Oh, Holy Land, Heavenly Father,
Uphold, with thy mighty hand,
The crown and land of Rumania.

SWEDEN
UR SVENSKA HJERTANS

Although an adaptation of the words of God Save the King is the Swedish national anthem, this song by the poet Strandberg has been adopted officially by the court and is sung on public occasions.

OUR Swedish feelings for our king
In voices patriotic sing,
God bless our land and king.
In cheerfulness and sweet content,
In happiness our lives are spent,
So sing with voices eloquent,
God bless our land and king!

ARMENIA
HYMN TO LIBERTY

The author of this song was a Russian Armenian, who fell under suspicion for his political opinions and suffered exile for them. Under the empire it was forbidden to possess a picture of Nalbandian; but portraits of him, with his poem on Liberty printed around the margin, were printed secretly.

WHEN God, who is forever free,
Breathed life into my earthly frame,
From that first day, by his free will
When I a living soul became,
A babe upon my mother's breast,
Ere power of speech was given to me,—
Even then I stretched my feeble arms
Forth to embrace thee, Liberty!

RUSSIA

The Hymn of Free Russia was composed by Konstantin Balmont, in Moscow, March, 1917, during the course of the Russian Revolution. Gretchaninoff, composer of this stirring martial music, is one of Russia's best known composers to-day.

YOUNG Russia, hail, victorious!
All praise we chant to thee.
Amid the nations, glorious
Thou standest, proud and free.

No tyrant shall enslave thee,
Thy sun arises bright!
All hail to those who gave thee
New Freedom's sacred light!

A song of countless voices
Resounds from shore to shore,
The Russian folk rejoices
With Freedom evermore!

SCOTLAND

WE'LL HA'E NANE BUT HIGHLAND BONNETS HERE

This stanza of the fine song by Alexander Maclagan breathes the spirit of the poem. The words of the refrain were shouted to his men by Sir Colin Campbell when charging the heights of Alma. The effect of this rallying cry is well known. The poem was dedicated to Sir Colin Campbell.

ALMA, field of heroes, hail!
Alma, glorious to the Gael!
Glorious to the symbol dear,
Glorious to the mountaineer.
Hark, hark to Campbell's battle-song!
It led the brave to victory;
It thundered through the charging cheer,
We'll ha'e nane but Highland bonnets here!
We'll ha'e nane but Highland bonnets here!
We'll ha'e nane but Highland bonnets here!
It thundered through the charging cheer,
We'll ha'e nane but Highland bonnets here!

JAPAN

The words of the Japanese national anthem are interesting, full of poetry and show that loyalty to the monarch as the representative of the whole people for which Japan is famous. The English version reads:

UNTIL this grain of sand,
Tossed by each wavelet's freak,
Grow to a cloud-girt peak
Towering above the land;
Until the dewy flake,
Beading this blossom's gold,
Swell to a mighty lake—
Age upon age untold
Joy to joy manifold
Add for our sovereign's sake.

PORTUGAL

PORTUGUESE NATIONAL HYMN

Portugal became a republic in 1910, and the new national hymn was written in celebration of this great event by Henrique Lopes de Mendonca. The rather free translation preserves the spirit of the original, which breathes through the verses.

NOBLE heroes of the sea,
Nation valiant and immortal,
Raise again thine ancient splendor,
Portugal!
Among the mists of memory,
O, my country, hear the voice
Of the great, illustrious dead
Who shall guide to victory.

Chorus

To arms, to arms, our country to free!
To arms, to arms, our country to free!
Against the cannon to march, to march!

Unfurl thine unconquered flag,
Living beam that lights the sky,
Europe cries to all the world
Unconquered still is Portugal!
Ocean kisses thy fair shores,
Laps thee with her loving waves,
Portugal with circling arms,
To the world new countries gives.

To arms, to arms, on land and sea!
To arms, to arms, our country to free!
Against the cannon to march, to march!
Greet the sun whose healing power
Shines upon the future rife;
Let the echo of attack
Be the signal of new life;
Rays of this, the coming dawn,
Like to mother's kisses are
To inspire and hold us brave
Against the blows of ruthless power.

To arms, to arms, on land and sea!
To arms, to arms, our country to free!
Against the cannon to march, to march!

GERMANY

DIE WACHT AM RHEIN

This was written by Schneckenburger in 1840, and its most popular setting was to a tune composed by Carl Wilhelm. France and Germany have had a long-continued struggle for possession of the Rhine.

WITH thunder shout the air is rent,
Like roar of waves and sword-clash blent,
"Now of the German Rhine so free,
Who will the river's guardian be?"
Thou, fatherland, mayst tranquil be,
Thy faithful sons will watch o'er thee,
Steadfast and true, each son of thine
Stands sentry o'er our noble Rhine!

The people hear that mighty cry,
Like lightning flashes ev'ry eye.
That landmark ev'ry heart will keep,
And watch unsleeping o'er the deep.

Thy tide reflects the heav'ns above,
And heroes gaze on thee with love,
And proudly breathe a vow to thee,
Thou, Rhine, shalt ever German be.

So long as blood flows in each vein,
Or hands to draw the sword remain,
And while an arm is in the land,
No foe shall walk upon thy strand.

The waves re-echo back the cry,
The standard in the breeze doth fly,
The Rhine, the German Rhine, so free,
Yes, we will all thy guardians be.

WALES

MARCH OF THE MEN OF HARLECH

This battle-hymn is beyond question the finest specimen of martial music in the world. The name of the composer is unknown, but it was probably written during the War of the Roses, when Harlech Castle was besieged on behalf of King Edward IV, 1468–69.

MEN of Harlech! in the hollow,
Do ye hear, like rushing billow,
Wave on wave that surging follow,
Battle's distant sound?
'Tis the tramp of Saxon foemen,
Saxon spearmen, Saxon bowmen,—
Be they knights, or hinds, or yeomen,
They shall bite the ground!

Loose the folds asunder,
Flag we conquer under!
The placid sky now bright on high
Shall launch its bolts in thunder!
Onward! 'tis our country needs us.
He is bravest, he who leads us!
Honor's self now proudly heads us!
Cambria, God, and Right!

Rocky steeps and passes narrow
Flash with spear and flight of arrow—
Who would think of death or sorrow?
Death is glory now!
Hurl the reeling horseman over!
Let the earth dead foemen cover!
Fate of friend, of wife, of lover
Trembles on a blow!

Strands of life are riven;
Blow for blow is given,
In deadly lock on battle shock,
And mercy shrieks to heaven!
Men of Harlech! young or hoary,
Would you win a name in story?
Strike for home, for life, for glory!
Cambria, God, and Right!

SERBIAN NATIONAL HYMN

This hymn was sung by the Serbs during the World War. It was translated by Isabel C. McCaw.

GOD of Justice, our salvation
In the years of pain and stress,
Help again the Serbian nation—
By Thy presence guide and bless;
'Neath Thy powerful wings maintain us
As we kneel before Thy face;
God of hope, defend, sustain us,
Serbian throne and Serbian race.

Through the long years of our dark past
Thou didst point our mission clear;
Now in union, glorious, steadfast,
Join all Serbian brothers dear.
Down the future years maintain us,
Shower upon our sons Thy grace;
God of hope, defend, sustain us,
Serbian throne and Serbian race.

GREECE
HYMN TO LIBERTY

These four stanzas of the Greek Hymn to Liberty rank with any national poetry which has been written. This translation by Mrs. S. G. Canoutas follows the original metre very closely and cleverly.

FROM thy fearful sword I know thee
With its sharpened edge and bright;
From the glance which as the lightning
Spans the earth in length and height.
From the sacred bones thou comest
Of the brave that are no more.
Liberty, we hail, O, hail thee,
Ever valiant as of yore.

There is silent expectation
Thou awaitest, sad and shy,
Till a voice of hope and valor,
"Come again," to thee should cry;
But that day was far and distant;
All was plunged in silence deep,
Crushed with terror, awed with darkness,
And benumbed in slavery's sleep.

Thou, alas, for only comfort
Hadst the splendor of past years,
Calling back the deeds of glory
And relating them with tears.
Then awaiting, still awaiting,
For a friendly freedom's call,
In despair thy hands thou wringest,
Weeping for thy bitter thrall.

When, oh, when, will some one call me
From the wilderness to rise?
Sounds of chains and groans and clamors
Was the answer to thy cries.
Then to Heaven thou upraised
A look dim with tearful flood
And upon thy robe were falling
Drops of pure Hellenic blood.

MEXICO
MEXICAN NATIONAL HYMN

OH, my country, entwine on thy temples,
Boughs of olive so fresh and so vernal,
When inscribed in the heavens eternal,
Blessed peace for all the land thou dost see!
But if stranger and foe, in their boldness,
Dare to tread on thy soil, they must perish.
Then oh! my country, this thought only cherish:
Ev'ry son is but a soldier for thee,
Ev'ry son is but a soldier for thee.

Chorus

At the loud cry of war all assemble;
Then your swords and your steeds all prepare,
And the earth to its centre shall tremble,
When the cannon's deep roar rends the air.
And the earth to its centre shall tremble,
When the cannon's deep roar rends the air.

SWITZERLAND
SWISS NATIONAL HYMN

The Swiss national hymn should not be confused with the national anthem, but this hymn is as well known, and by many people is considered the national song of Switzerland. It was written by Leonard Widmer in 1848 and translated by C. Fred Silberbauer.

WHEN Thou com'st with reddening dawn,
Thee I see in rays of morn,
Thro' eternity and time, Lord Sublime!
When the Alps are crimson-glowing,
Be your prayers, free Switzers, flowing
Unto God, Whose Fatherland
Leads you to His Heavenly Land.

When the shades of eve are here,
Thee I find in starry Sphere,—
Thee as Friend of man adored, Loving Lord!
From yon shining realms Elysian
Grant to me that blessed vision
Which true spirits understand:
God, in Heavenly Fatherland.

If thick mists the heights enshroud,
Then I seek in seas of cloud
Thee, whose depths no man can learn, Loving Eterne!
Lo, o'er vapors gray victorious,
Leads the sun his pageant glorious,
Bidding earthlings understand:
God in Heavenly Fatherland.

As Thou ridest the raging blast;
Be Thyself our Refuge fast
Whose hid purpose cannot err, Rescuer!
In each night of storm and terror,
Childlike trusting without error,
May our spirits understand:
God in Heavenly Fatherland.

IRELAND
THE WEARIN' O' THE GREEN

The song appeared as a street ballad during the Irish rebellion of 1798. It was forbidden by the authorities, who also sternly repressed the wearing of the shamrock as the national emblem.

OH! Paddy dear, and did you hear the news that's goin' round?
The shamrock is forbid by law to grow on Irish ground;
Saint Patrick's day no more we'll keep, his color can't be seen,
For there's a cruel law agin the wearin' o' the green.
I met with Napper Tandy and he took me by the hand,
And said he, "How's poor old Ireland and how does she stand?"
"She's the most distressful country that ever yet was seen,
They're hanging men and women there for wearin' o' the green."

Then since the color we must wear is England's cruel red,
'Twill serve but to remind us of the blood that has been shed;
You may take the shamrock from your hat and cast it on the sod,
But never fear, 'twill take root there tho' under foot 'tis trod.
When laws can stop the blades of grass from growing as they grow,
And when the leaves in summer time their verdure dare not show,
Then I will change the color that I wear in my caubeen,
But till that day, please God, I'll stick to wearin' o' the green.

But if at last our color should be torn from Ireland's heart,
Her sons with shame and sorrow from the dear old isle will part;
I've heard a whisper of a land that lies beyond the sea,
Where rich and poor stand equal in the light of freedom's day.
Oh, Erin, must we leave you, driven by a tyrant's hand?
Must we ask a mother's blessing from a strange and distant land?
Where the cruel cross of England shall never more be seen,
And where, please God, we'll live and die still wearin' o' the green.

O CANADA

This version of Canada's national song, written by Frederick George Scott, Senior Chaplain to the First Canadian Division in the World War, was the first song of the troops at Neuve Eglise, Belgium, in 1915.

O CANADA, my country and my love!
O Canada, with cloudless skies above!
Where'er I roam, where'er my home,
My heart goes back to thee,—
Thy lakes and streams, thy boundless dreams,
Thy rivers running free.
O Canada, O Canada!
God pour His blessings on thee from above,
O Canada, my country and my love!

CHANT NATIONAL

The French Canadian national hymn was written by Basile Routhier and first published in Les Echos, Quebec, 1882. The national song in English, written to the same air, is on this page.

O CANADA! terre de nos aïeux,
Ton front est ceint de fleurons glorieux,
Car ton bras sait porter l'épée,
Il sait porter la croix.
Ton histoire est un épopée
Des plus brillants exploits;
Et ta valeur, de foi trempée,
Protégera nos foyers et nos droits.

POLAND
JEZCZE POLSKA

Skrzynecki, a Polish officer, was commander-in-chief of the Polish forces in their struggle to free themselves from Russian rule (1830–31). He gained some brilliant victories, but hesitated to pursue his advantage. The suspicion that he was in league with the Russians led to an inquiry, and he resigned.

POLAND'S not a slave for ever while her sons alive remain,
What she lost, our strong endeavor soon shall win again,
March, march, Dombrowski, lead us to liberty,
All our chains are cast away,
Poland shall at last be free.

HEAR, O YE NATIONS!

This beautiful hymn by Frederick Lucian Hosmer, written in 1909, five years before the outbreak of the World War, seems a prophecy of the time to come when war shall be no more.

HEAR, hear, O ye nations, and hearing obey
The cry from the past and the call of today!
Earth wearies and wastes with her fresh life outpoured,
The glut of the cannon, the spoil of the sword.

Lo, dawns a new era, transcending the old,
The poet's rapt vision, by prophet foretold!
From war's grim tradition it maketh appeal
To service of all in a world's commonweal.

Home, altar, and school, the mill, and the mart,
The workers afield, in science, in art,
Peace-circled and sheltered, shall join to create
The manifold life of the firm-builded state.

Then, then shall the empire of right over wrong
Be shield to the weak and a curb to the strong;
Then justice prevail and, the battle-flags furled,
The high court of nations give law to the world.

And thou, O my country, from many made one,
Last-born of the nations, at morning thy sun,
Arise to the place thou art given to fill,
And lead the world-triumph of peace and good will!

GAMES TO PLAY ON THE BEACH

CONTINUED FROM 6148

WE all look forward to our vacation at the seashore, and our first desire when we reach our destination is to get down to the beach with spade and pail and to build castles of sand with trenches all round. A great deal of fun and amusement is to be obtained from castle-building, especially if there is a party of boys and girls. In this case it is better, instead of trying to build an elaborate castle that will be a model of a real castle, to pile up sand into a great heap, and dig a deep trench all round, and then, dividing the party equally, to play "King of the Castle." One side holds the fort while the other tries to take it by storm, and, as the sand is soft, we do not hurt ourselves at all as we fall down or get pushed from the castle. For this game we should select a spot where there are no rocks nor big stones, and where the sand is dry. The bigger the castle that we build, the greater will be the fun. The attacking side may be considered to have won the game when they have turned all the members of the other side off the castle, or a flag may be posted in the middle of the fort, and if the attacking side can seize the flag and take it away, they may be considered victorious.

If there are only two or three in the party —not enough to form sides for playing the "King of the Castle"—then it is better to build a castle that will be a good model of a real castle. We must decide upon the shape that the castle is to be, and a very good style is a castle with a round tower at each of its four angles, the tower to be joined up with walls. The tops of the towers and walls should have battlements, and these may be cut, after the castle is built, with an old knife. For scooping out gateways and windows in the walls, an old iron spoon is very useful. For model castles of this kind, it is wise to use wet sand, which will cling well together; otherwise, if we use dry sand, the castle is sure to collapse when we begin scooping out gateways and windows. If there is no wet sand available, we can easily sprinkle seawater from our pails over the dry sand. The beauty of the castle will, of course, depend largely on the skill and artistic taste of the builders, but it is surprising what perfect models of castles can be built in sand upon the sandy beach.

An excellent game for the beach is trench-digging, and we can easily arrange a competition in which the one who digs the largest and deepest trench in a given time shall be declared the winner. We might make the competition one in which a hole or a pit of a certain diameter and depth has to be dug and filled with water from the sea, the sea being allowed to run into a hole through a trench which each competitor must dig. The one whose pit gets filled with water first is declared the winner. Of course in a competition of this kind the spades of the competitors should all be alike as to size and material. It is much easier to dig with a large metal spade than it is to dig with a small wooden one.

A tug-of-war is always exciting, but it is more exciting than ever when played on the beach. The sand makes the result very uncertain. At one time it enables the competitors to get an apparently firm foothold, and then it suddenly and treacherously gives way, so that the ground gained or held is lost. The competitors may, of course, wear their shoes or be barefooted, but all competitors should be alike in this respect; that is, if any are barefooted, all should be. Then, again, the sand being so soft, a fall does not hurt us in any way. If the tug-of-war is pulled barefooted, we must be careful to choose a part of the beach where there are no pieces of glass or broken shells. A mark such as a band of seaweed, must be put midway between the two sides before

they start pulling, and the side that pulls any of its opponents over this mark is the winner.

If a long, clean stretch of sand can be found on the beach, some good races may be run, with the competitors either barefooted or wearing shoes. The results of these races on the beach are always uncertain, because running on sand is very different from running on the pavement or an ordinary road or a field, and far more difficult. When there is no clear track of any considerable length for running on the beach because of pebbles and rocks, we can arrange a steeplechase, and there is much excitement in climbing over these obstacles. We must be careful, however, that in the excitement of the race we do not fall. Care must be exercised in climbing over rocks.

On a beach where there are plenty of pebbles mixed with the sand, a good game is to select some short sentence, and to collect white pebbles and form the words on the sand with these pebbles. The one who is first in forming completely and artistically the sentence that has been selected wins the game.

Boy and girl scouts, and those interested in scouting games, can have plenty of amusement on the beach, especially if there are boulders behind which to hide. Then we shall find the beach an excellent place in which to do signaling.

These are only a few of the many games that may be played on the beach, and we shall find that if we organize our play—that is, engage in definite games—the time passes much more pleasantly than if we have no regular and settled system of playing.

CAN YOU FIND YOUR WAY INTO THIS MAZE?

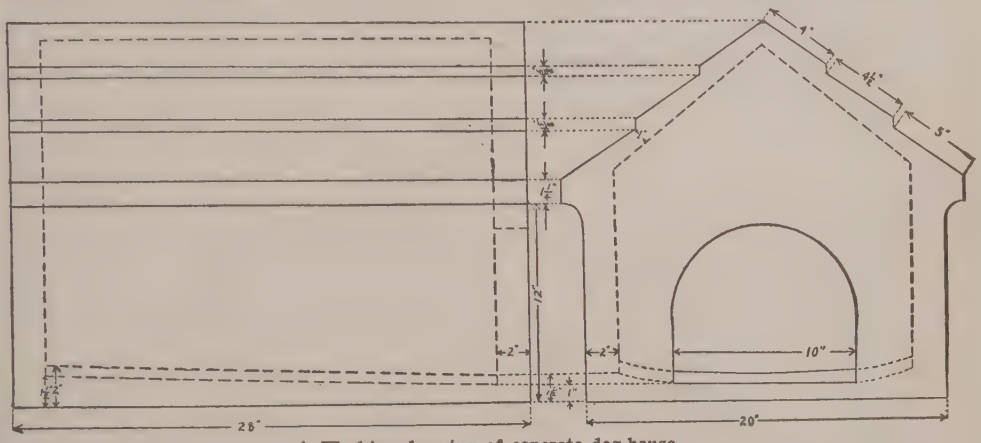
IN the centre of this maze is a goat that has strayed in from the outside and does not know how to escape. It looks very simple to enter by the opening at the bottom of the maze and to reach the centre, but it is not so easy as it looks. Let us see if we can reach the goat.

Do not spoil this page of the book, but take a piece of tracing- or tissue-paper, or any other transparent paper, and trace off the lines of the maze. Then, starting at the opening at the bottom, try with a pencil or point to trace your way to the goat without crossing any lines.

HOW TO MAKE A CONCRETE DOG-HOUSE

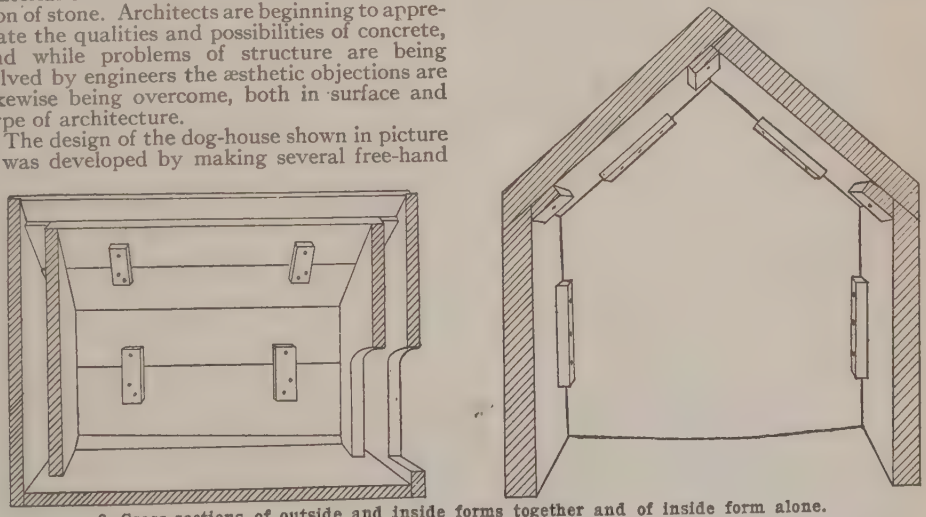
ALTHOUGH concrete as a building material is not yet thoroughly understood, there is little doubt of its immense value for construction work. When once the material is sufficiently well known experimentally to be properly used its applications are certain to increase rapidly. The sudden and enormous development of the concrete industry has perhaps taken both architects and house purchasers by surprise. Due to a lack of knowledge of the substance, design based alone on concrete structure has been impossible, and the new material is still too often treated as an imitation of stone. Architects are beginning to appreciate the qualities and possibilities of concrete, and while problems of structure are being solved by engineers the æsthetic objections are likewise being overcome, both in surface and type of architecture.

The design of the dog-house shown in picture 1 was developed by making several free-hand sketches which suggested a variety of proportions and details. The best features of these were combined in a full-size drawing, more carefully made, and the working drawing was made from this. The walls are 2 inches thick, the roof is 1 inch at the thinnest parts, and the floor tapers from 1 to 2 inches, with a decided slope toward the door to allow for washing. The reinforcement consists of a skeleton house of ½-inch wire netting, which stands midway in the walls, and as low as possible in the floor and roof, to bear the tensile strain. In planning the exterior an effort has been made to avoid the usual abrupt lines and monotonous surfaces, without making the mold complicated. The curve under the eaves, the corresponding curve of the doorway, and the proportioned shadowing lines across the roof have been planned with this purpose in mind.



1. Working drawing of concrete dog-house.

The outside form, as shown in picture 2, is to be built up on a board foundation. First the ends are made exactly the shape and size of the ends of the kennel, then the sides and roof are made to overlap. The side boards should be planed off to form the curved molding under the eaves. Straight boards nailed to the sides will complete the fixed part of the form. The roof boards, three on each side, are simply fitted and left loose to be used later. The inside form

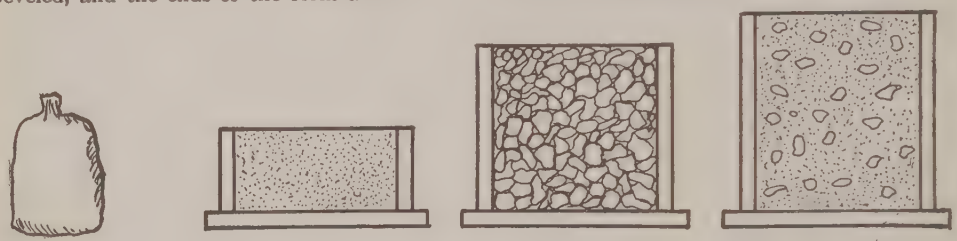


2. Cross-sections of outside and inside forms together and of inside form alone.

is simpler in outline, but the construction involves a little more thought. The boards will need to be narrow enough for removal through the doorway; no fastenings can be used from the outside, and rigidity is necessary. No floor is to be made for the inside form. Each of the six other faces of the box should be made in two longitudinal parts which are held together by means of blocks fastened by screws to each part across the joint, inside the form.

The parts are then nailed together securely from the outside to secure the proper fitting of joints. In order to leave room for the removal of side and roof boards, their ends should be beveled, and the ends of the form allowed to project slightly. To locate parts for joining, cleats can be nailed to the roof, as shown in picture 2, and also to the roof and sides next to the ends, to hold these the desired distance apart. The nails from outside are then removed and the form is tied together on the inside by means of stout cord either attached to screws or passed under the screwed blocks. The inside form is made waterproof with shellac and oil, the outside with oil only, which seems about as effective for this purpose. This is necessary in order to keep the boards from warping and swelling with moisture, especially those of the inside form.

A rather rich mixture of concrete should be used: 1 part of cement to 1½ parts of coarse, sharp, screened sand, and 3 of grit, or fine gravel. These are well mixed and wetted as needed with just enough water to come to the surface after thorough tamping (see picture 3). The outside form is then set up with the wire reinforcement (except for the roof) in place. The floor is tamped in and graded smoothly to a line on the outside mold. Then the inside form is placed inside the wire by means of guide lines, and the doorways of the two forms are joined by nailing sheet-tin around the curve. The walls are raised gradually, always by spading against the forms to bring a good surface and by tamping to exclude air spaces. When the walls are raised to the eaves and near the gable, the wire roof should be placed in position and the roof concrete rammed into place, the three boards on each side being secured in position, as needed, with nails and stout cord. The very top is left open. It is simply smoothed off with the trowel in the desired curve.



3. Showing ingredients and resulting mixture.

The forms can be removed after about twelve hours. The inside should be removed first. In dry weather this might be done safely even earlier. The cords are now cut loose, the cleats are pried off, and the screwed blocks are removed, which makes the boards free for removal inward. The outside form should be removed last. At this stage the concrete will still be found "green" enough to allow for necessary trimming up of the corners. About a week or ten days should be allowed for curing before the kennel is moved about.

HOW TO PREVENT STATIC IN YOUR RADIO

THE amateur radio fan soon learns that a long outside antenna picks up more static than any other type. Sometimes he loops or puts single-wire aerials indoors, either in the attic or in the cellar. However, both of these cut down signal strength proportionately with static, except in the case of loops, which usually are employed in connection with several stages of radio-frequency amplification. Few, however, have ventured to experiment with underground antennæ. Recent publicity on this subject has made of it something of a mystery, though the theory is almost as old as radio.

It was successfully used by the United States Army during the World War, having been found to give the greatest ratio between signal and static, favorable to the former. This means that, in comparison with the overhead antenna, the underground system will receive nearly the same signal strength, but little static, the ratio being 10 to 1 in favor of the buried aerial.

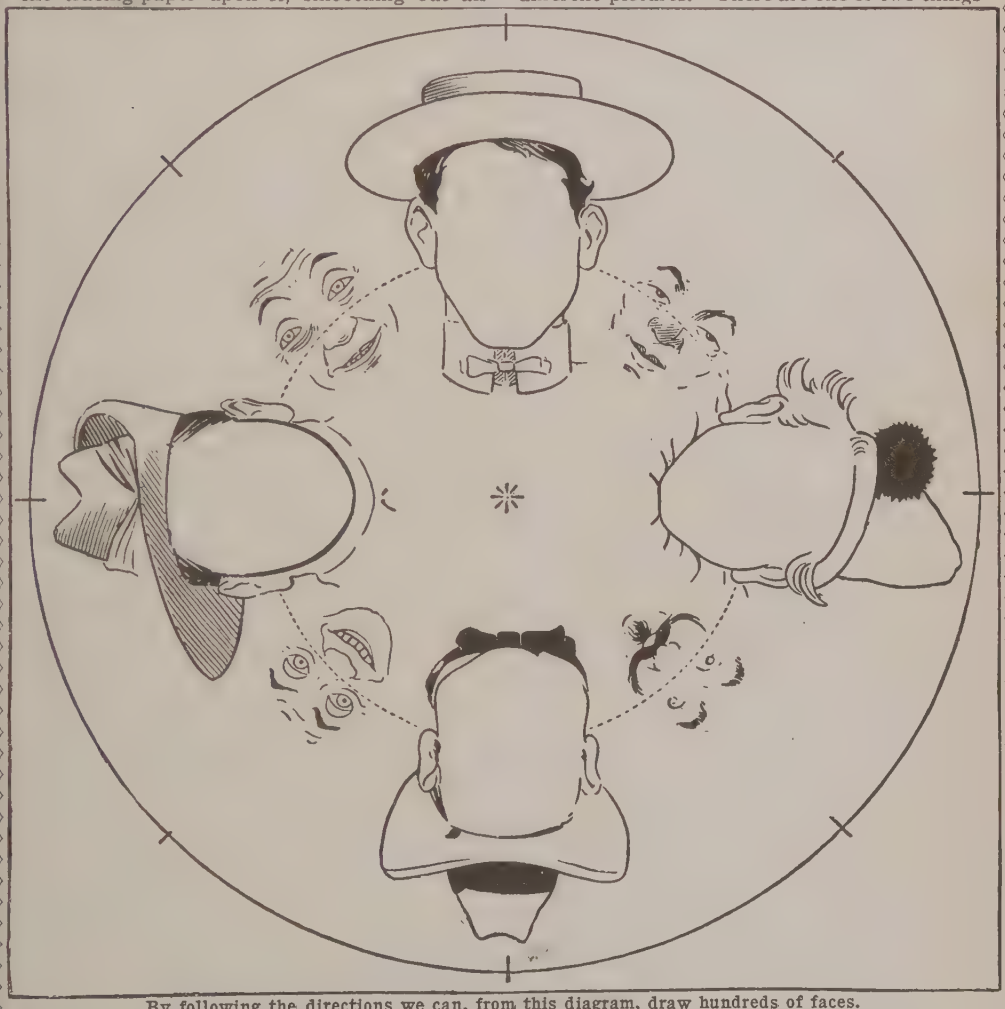
Try this type of antenna with your own receiving equipment. Use a single piece of No. 14 rubber-covered wire, such as is used in house-wiring, the end to be put into the open end of a shotgun shell, or can, and the shell filled with sealing wax, to keep the wire from corroding after contact with damp earth.

The antenna wire is buried one foot underground, the end that is to be used as a lead-in being brought to the surface directly beneath the window near which the set is located. A piece of lead tubing is slipped over the lead-in, completely shielding it from the antenna binding-post of the set to a point just beneath the ground. This shield is grounded to the water-pipe, like the ground-wire proper. This keeps the exposed part of the antenna from picking up energy from the air. As an extra precaution, shield the regular ground wire in a lead tube, though you doubtless will find this unnecessary. This underground antenna will be found to be practically non-directional, signals from all parts of the country coming in better than on the outdoor aerial in summer months.

HOW TO DRAW HUNDREDS OF FACES

WITH the diagram on this page we can draw hundreds of different pictures, even though we may not be artists in any sense of the word. First of all we should take a piece of good tracing-paper and trace the diagram upon it quite carefully and accurately. Then we should ink over the lines, and when the ink is quite dry paste the tracing-paper with the design upon a piece of cardboard. To do this we cover the card with a smooth paste and lay the tracing-paper upon it, smoothing out all wrinkles with a clean cloth. When this is dry we are ready to draw any number of faces. We take a piece of tracing-paper and pin it down upon the card, pressing the pin through the centre of the diagram where a star is marked. Now we must trace any one of the hats upon the transparent paper. Then we turn the paper round until the hat that we have drawn comes over one of the other hats in the diagram. Now trace the shape of the face that appears under our hat. Again we turn the tracing-paper round until one of the pairs of eyes comes into position within the outline of a face that we have drawn. Trace the eyes with pencil, and finally turn the paper round to another position and trace a nose and mouth. We now have a complete face with eyes, nose, mouth, hair and hat.

By ringing the changes and drawing the different eyes in the different face outlines, and putting sometimes one hat or mouth and sometimes another, we are able to make hundreds of different pictures. There are one or two things to remember if we want to be successful in thus producing an imaginary portrait gallery. The tracing-paper must be pinned down firmly upon the card and must not be allowed to shift about, or the different parts of the different faces will not join up properly. Then we should use a soft black lead-pencil in tracing the faces, and we must not press too heavily or we shall indent the card and spoil the diagram. We can ink over the pencil-lines afterward. Colored inks can be used if we fancy them.

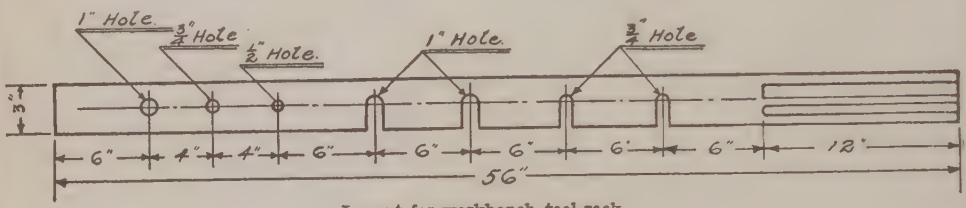


By following the directions we can, from this diagram, draw hundreds of faces.

CONVENIENT WORKBENCH DEVICES

ON page 4013 you were given detailed directions for constructing a practical workbench. Those who have decided to make this, or any similar workbench, will also desire to have several workbench devices or accessories to add to the convenience of using it. For these valuable additions a pine board about 6 inches wide, 1 inch thick and 16 feet long should prove sufficient to make the devices or accessories you will need. A finished board should be secured from the planing-mill if you do not have one at hand.

One of the first things needed for the workbench is a tool-rack, in order that each tool may be easily located as it is needed and replaced again after it has been used. To make the tool-rack, first cut from the board two 56-inch lengths. Then cut one of these lengthwise with a ripsaw. Next plane the edges smooth and square with the face, or flat, side of the board. Now lay out the positions of the centres of the holes as shown in picture 1. When the centres have been determined, bore the holes according to the sizes indicated, with a bit and brace. The first three holes at the left are to hold bits; the next two are for chisel and gouge, and the other two are for screwdrivers. These latter four, after the holes are bored, are made open clear to the edge of the rack by sawing out a section from the front, as shown. This makes it possible to take the tools out without lifting them entirely out of the rack. From the right-hand end mark off a distance of 12 inches. Then, from the end to this line, cut two grooves as shown in the drawing. The front one can be rounded out with a gouge to hold a pencil, while the back one might be made square and flat with a chisel, to hold either a 12-inch scale or a folded 2-foot rule. In the front edge of this piece, about 6 inches from the right-hand end, you may drive a nail to hold the claw hammer.

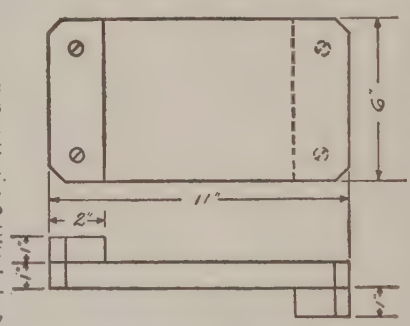


Layout for workbench tool-rack.

The 56-inch length which was not ripped in two should be fitted at right angles to the back of this rack, lapping over the edge and flush with the top. It may be nailed or screwed in position with two suitable supporting brackets fitted under each end of the rack for strength. When you have this all fastened together, the whole rack should be set up on top of the back pieces of the workbench and held in place by two cleats which are 3 inches by 8 inches. These should be screwed both to the back piece of the bench and to the back piece of the rack.

Underneath the holes for the bits two nails should be used to hold the brace. The jack plane, the block plane, and the spokeshave, if this is used, may stand on the bench underneath the rack. Screws or nails placed at the end of the bench will hold the ripsaw, the crosscut saw and the dust brush.

Next in usefulness is the bench-hook shown in picture 2. For this, cut one piece of wood 6 inches by 11 inches, and two pieces 6 inches by 2 inches. All these pieces must have the grain running in the longest direction. When these are trued up, fit them together as shown, by fastening with 1¾-inch wood screws. After completing this the corners are cut off. The hook fits over the front edge of the bench near the right-hand end and forms a brace when one wants to hold a piece of wood steady for sawing. This is a great convenience.



Working drawing of bench-hook.

You will also need a bench-stop. When you are planing a wide, flat board the vise is sometimes of little use. Holes are bored in pairs in the top of the bench itself, and these bench-stops are made of a size to be slipped in to form a buffer. A little piece of wood 1 inch by 1 inch by 2 inches is used, having the grain run the long way. For half of the distance the stop remains square, while the other inch is rounded with a chisel to fit into the hole, which should be slightly more than 1 inch deep. At least two of these stops will be needed.

Your workbench also needs a nail-box. A satisfactory one may be made from two pieces 3 inches wide by 14 inches long, which form the sides, two ends 3 inches by 3 inches, and a bottom piece 5 inches by 14 inches. The side pieces are nailed over the end pieces, and the bottom fits over all of them. This makes the inside measurements 3 inches by 12 inches. Of course it is desirable to keep the different sizes of nails separate, so this box is divided by partitions into as many compartments as are desired. These are made from odd pieces of wood about ½ inch thick. These should

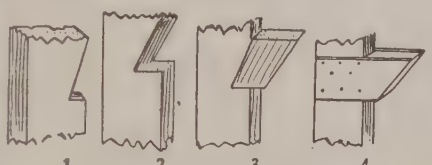
measure 3 inches by 3 inches, and may be placed wherever you like. However, one of these partitions should be higher than the rest, and should be placed in the centre, so that it will serve as a handle as well as a partition.

Another convenience, but not entirely necessary, is the mitre-box. It consists simply of two side pieces 5 inches by 12 inches, and one bottom piece 4 inches by 12 inches. The side-pieces should be fitted down over the edges of the bottom piece and then nailed fast. (There are no ends to the mitre-box.) When this has been done, use a 45-degree triangle, and across the two top edges make a perpendicular line, and then a 45-degree line in each direction, but so that these do not overlap. Then saw straight down from these lines to the bottom piece. The mitre-box will prove a great convenience in sawing the corners of molding or anything which requires a fitted corner. The piece to be sawed is held firmly in the box and the saw is merely guided through the slots.

When a boy has made the bench and all of these accessories, and has some suitable tools, he will then be equipped for doing construction work of a real practical nature.

MAKING AND USING A PAIR OF STILTS

STILT-WALKING is good healthy exercise, and any boy can make his own stilts, so that the pastime can be followed without the expenditure of much money, or, indeed, of any money at all. It should be possible to get two pieces of wood 6 or 7 feet long and about 1½ inches square. The wood should be as free from knots as possible, because knots rather weaken the wood. The pieces of wood should have a shoulder made in each, as seen in pictures 1 and 2, about 2 feet from the bottom end. Then from this shoulder the wood should be made to slope up for a few inches, as also seen in these pictures. Now we make two blocks, as seen in picture 3. These blocks should be 3½ inches wide and just as thick as the stilt-leg that we have already made. We should fix the blocks, as shown in pictures 3 and 4, into the shoulders. Now the next thing to do is to fasten the blocks to the stilt-legs. We can do this by putting nails, long screw-nails for preference, right through the legs into the blocks, taking care not to split either of them. An easier and perhaps better way is to put a piece of board cut to the proper shape on both the front and the back of each stilt, as seen in picture 4, and if this piece is made so that it is the exact height of the top of the block, it will increase the size of the foothold, which is a good thing to do.



1 2 3 4

Making the step, or tread.

The top half of the stilts should be cut round instead of being left square, so as to give a good grip for the hands. This can be done with a pocket-knife or a spokeshave. We may, if we like, smooth the handle part by scraping it with a piece of broken glass, or by rubbing it with sand-paper. Now the stilts are ready for use, and a little practice will enable us to feel at home on them. The upper part goes behind the shoulders, as seen in picture 7, and below that the hands grip the round part, so as to steady the bearer. When we practice with the stilts we must begin by mounting them beside a wall or a fence, but after a time, when we have begun to feel more at home, we shall be able to get on to them without any such aid.

5 6 7

Three different kinds of stilts.

We have described how to make the simplest form of stilts. Picture 6 shows a boy using a more advanced pair. They are much shorter, and do not go up as far as the shoulders. The steadying is done by the hands, which are held not quite fully extended. Also the foot-blocks have straps to steady the feet. Picture 5 shows a yet more advanced type. Here all the work is done by the legs, and there are knee-straps as well as foot-straps, the hands not holding the stilts at all. A long pole in one hand will help to steady the user.

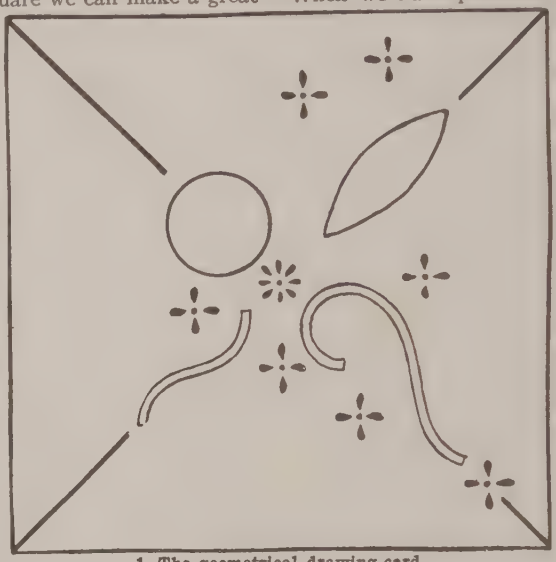
THE MEANING OF HALLOWE'EN

HALLOWE'EN, which brings to most of us visions of fun and jollity, is an old, old festival. The old Romans held it about the first of November, in honor of Pomona, the goddess of fruit trees. In Britain the Druids celebrated a festival at the same time in honor of the sun god, and in thanksgiving for harvest, and the two festivals seem to have become one in the minds of the Britons. When the people became Christians the early Church Fathers wisely let them keep their old feast, but gave it a new association by holding it in commemoration of all saints and martyrs. Thus the eve of the festival came to be called All Hallow E'en. The name comes from the old English word *halwe*, or as we now say, *holy*.

Many beliefs grew up about this feast, such as the belief that on this one night of all the year the spirits of the departed were allowed to visit their old homes. In many parts of the old countries food was left, hearths were carefully swept, and chairs were set in order before the inhabitants of the villages went to rest. Now, of course, this custom has passed away.

A CARD THAT HELPS US TO MAKE DESIGNS

IN picture 1 we have a square with a black line running from each corner toward the centre, and contained in this square are four designs—one a circle, another shaped something like a leaf, the third is like an interrogation point and the fourth is a double curve, something like a printed S flattened out nearly straight. In addition to these four figures there are eight stars dotted about at intervals. From this simple square we can make a great number of different designs, some of which are very complicated. We must take an exact tracing of this square, and cut out a similar design on cardboard. This will save us from spoiling our book. Having cut out the square in cardboard, we place it upon a sheet of white paper, and run a pin through the black dot in the centre of a little star—any star will do. We must be very particular to see that the pin holds firmly, otherwise our design will be spoiled. We shall now begin to make our design, using, let us say, the circle. We take a soft lead-pencil that has been sharpened to a fine point, and make a mark on the white paper opposite the corner of the square, the line from which points to the circle.



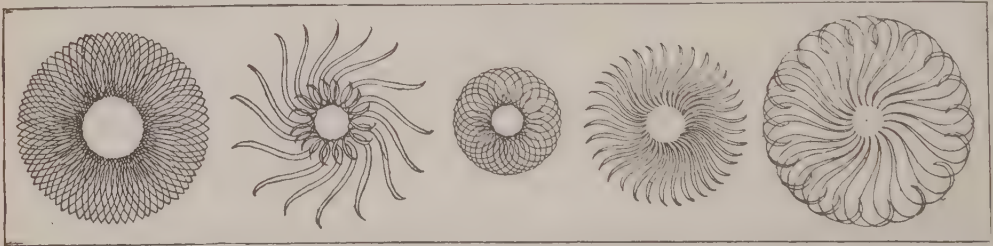
1. The geometrical drawing-card.

Beginning on the edge of the circle nearest the centre of the square, we draw round and round the circle continuously again and again, but as we are drawing we keep on gradually and slowly shifting the square card round a little to the right. We keep on drawing round and round the circle, and at the same time moving the card slowly and evenly round at the same pace until the corner comes back to the spot from which it started. If we now remove the card, we shall find on the paper a circular design similar to the middle one shown in the set of designs in picture 2. Whether the lines are close or wide apart depends upon the rate at which we move the square card round as we are drawing the circles. If we want the lines very close, we must shift the square slowly; if we prefer them wide apart, we must move the square quickly.

The important thing is to see that we move the square at the same pace throughout. If this is not done, we shall get an irregular design instead of the neat and regular design we expect. When we have practiced with the circle we might try the leaf design, drawing our pencil round and round as we did in the circle. In making designs from the other two figures the pencil must be run continuously from one end of the figure to the other, backward and forward, along the whole length of the curve or slit. Picture 2 shows a few of the simpler designs, but when we become more expert we can use two, or even more, of the figures in making one design, thereby getting very beautiful and intricate patterns. The designs will be of different sizes, according to which star it is that we place the pin through as a centre.

There are several things we must not overlook. To begin with, we should always make the pencil-mark opposite one corner of the square, so that we know exactly when the card has been right round on the pin. If this is omitted, we shall probably overrun the starting-point and spoil the design. Much depends, too, upon the pin remaining upright and immovable, for if it shifts we shall spoil the regularity of the pattern. Above all, we must remember that the whole beauty of the picture we are making depends upon the uniform rate at which we move the square and the pencil.

The designs shown in picture 2 are only a few of the beautiful patterns that can be made with this little device.



2. Some of the designs that can be made with the geometrical drawing-card.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 6385.

Photo, Publishers Photo Service.

The City Hall in the old city of Heidelberg.

THE LITERATURE OF GERMANY

PART I

CONTINUED FROM 6154

WHEN we use such phrases as "spick and span," "bed and board," "wind and weather," "weal and woe," "hearth and home," we are in touch with ancestors of ours who lived in the dark forests of Germany long before the birth of Jesus.

Notice in each of those phrases that the two coupled words begin with the same letter. We do not say that So-and-so looked *spick and neat*, or *spick and clean*, but that he looked *spick and span*. "Spick and span" sounds smoother in our ears than "spick and clean," it runs with a certain pleasant quickness; it seems to say exactly what we mean, although few of us know the exact meaning of *span*.

In this easy way spoke our earliest ancestors. They used words beginning with the same letter in their poetry and in their household talk. One of their earliest poems ran in this fashion:

Woe now, Wielder above, Woe-Weird cometh;
I have Wandered Summers and Winters Sixty abroad,
And ever have Found me where Fighters Foregathered,
Yet Before no Burg did Bane Befall.

This we call alliteration. It is found in William Langland's old English poem Piers Plowman:

Her robe was full rich of red scarlet engrained,
With ribands of red gold and of rich stones.

Chaucer used it; Spenser's poetry is full of it. We find lines in Byron and Tennyson, indeed in nearly all poets, which make use of "apt alliteration's artful aid," while all of us are familiar with it in nursery rhymes, such as *Peter Piper picked a peck of pickled peppers.*

In poetry there is also another link with the most distant past of our race. How do we get the four beats which we find in the commonest of all our measures? We get them from the Aryan priests of ancient days who took four steps to the altar of sacrifice and four steps backward, or four to the right and four to the left. While they thus moved in this mystic rite the musicians played and the worshipers sang, and the music beat time to the steps of the priests, and the singers sang to the music. If Tennyson's In Memoriam had been chanted in those remote ages it would have sounded like this:

Strong Son of God,
Immortal Love;
Whom we that have
Not seen Thy Face
By Faith, and Faith
Alone Embrace;
Believing where
We cannot prove . . .

Thus we learn to see how many things that are perfectly familiar to us in this age of airplanes and wireless stretch far back to ages so remote in human history that to think of them is to feel that the Roman Empire was an affair of only the other day. Their interest for us is tremendous: one of the most romantic interests that can occupy our minds; for in thus going back to the thoughts and ideas of our ancestors we feel ourselves heirs of a marvelous past and trustees for a future which must surely fulfill the dreams of the human soul.

German literature has this special interest for us more than any other in the world. Its beginnings are our beginnings. Its earliest ideas are the fountain of our ideas. In our minds is the heritage of men who overthrew the legions of Rome and established a nobler and grander civilization on the shores of the North Sea. If we can discover how these men thought about nature and about themselves we shall understand some of the reasons for those thoughts in our own minds which are stronger than ice and as fierce as fire.

THE CIVILIZED PEOPLE WHO MARCHED INTO EUROPE FROM THE EAST

The Germans belonged to the Aryan race. Before they migrated from the East and marched into Europe they were already civilized. They were herdsmen, and understood some of the arts of agriculture. It would seem that they were gentle and even sentimental. Their religion was faith in gods who were well-disposed toward men and in giants who were opposed to men. When they heard thunder they trembled and called it the battle-cry in the war of gods and giants. As for nature, everything was either male or female, even things without life. The sky and the sun were male; the moon and the earth were female. Later, when climate and clashes with the Celts had made them a warlike people, they exalted the idea of woman and worshiped a goddess named Nerthus. Even when they were of all peoples on earth the most fierce and terrible, the wife of the god of thunder was the goddess of peace.

They believed, says Scherer, speaking of this old mythology, that after the last dread struggle between gods and giants, after the great conflagration in which the sun will be blackened and the earth disappear, the souls of the faithful will enter an eternal realm of peace. "Then the earth, green and beautiful, will rise again from the sea, and corn will spring up unsown; all evil will disappear, and sinless gods will reign forever."

This great critic is convinced that there was a time in the religion of our ancestors when love of beauty and reverence for woman predominated. It was then that the Aryan sun-god was changed into a goddess, and later received the name "She who must fight her way."

THE NATIONAL HERO WHO MADE WAR FOR THE SAKE OF PEACE

Later, but still early in German history, we come to the supreme national hero Siegfried, whose name means that he makes war only for the sake of peace:

> He is the ideal of a hero and a perfect man; the gods and the good spirits are favorable to him.
>
> The clever dwarfs educate him; he learns the trade of a smith, and a godlike woman initiates him in sacred wisdom. He is early surrounded by the glory of wonderful deeds; riches and power are his portion; love beautifies his life; but he falls by the treachery of a powerful enemy, and his early death raises him to higher glory.

This Siegfried is the very soul of German literature. The first Siegfried of legend is all but lost to us; no one can be quite certain about him, and as he comes down the ages, every glee-singer, every poet, gives him the color of that particular age, so that he is never the same, and yet always the ideal German, the hero of the German imagination. We shall see that he and his companion Parzival were laughed out of existence in the seventeenth century by a character named Simplicissimus, and revived again by the genius of Wagner in the nineteenth century. To understand Siegfried is to understand the German character both at its worst and at its best.

THE OLD POEM UNLIKE ANYTHING ELSE IN THE WORLD'S LITERATURE

It was in the twelfth century that an unknown Austrian poet made this legendary Siegfried the hero of The Lay of the Nibelungs, or, as we now call it, the Nibelungenlied. It is a poem by itself, unlike anything else in the literature of the world. It preserves something of the nature-worship of the old Germans, something of the pagan beauty which inspired the earliest songs of Siegfried; but it is expressed in the language of chivalry and is given a gloss of Christianity to suit the temper of the Middle Ages.

The truth is that the Germans were never really converted to Christianity, but adopted it at the order of their chiefs. They remained pagans at heart for many centuries. Their real literature is thus entirely lost to us, for the monks were the only people who could write, and these monks were always composing works to make those stubborn Germans forget their gods and goddesses, their demons and dwarfs, their worship of nature.

A REMARKABLE THING THE ROMANS NEVER KNEW ABOUT THEIR EMPIRE

We can guess what their literature was like by the fact that there is no German Jubilate to celebrate the overthrow of Rome, but only old folk-songs telling of the brave deeds of individual men. The central feature of German character was admiration for the heroic in man.

Remarkable is it for us to think that the Romans never knew that their mighty empire had been destroyed by their own blood-relations. They regarded the Germans as frightful barbarians belonging to an altogether different race; they never knew that these barbarians were, like themselves, of gentle Aryan descent, and, like themselves, had learned in the sterner climate of Europe to admire the heroic in man and to believe in courage as a supreme virtue.

The journalists of Germany were glee-singers who wandered up and down the country singing songs of heroic men, and keeping alive in the German heart its love of Siegfried and its hope of peace. The most famous of the minnesingers, or glee-singers, was Walther von der Vogelweide, the master lyric poet of Germany for several centuries.

WALTHER VON DER VOGELWEIDE, THE "SWAN OF GERMANY"

He was born in the latter half of the twelfth century, though both the year of his birth and his birthplace are unknown. The town of Botzen, in Tyrol, erected a fine monument to his memory, but we cannot be sure that he was born there. It is also claimed that he was born near Sterzing. He grew up in the country and learned to love country things, such as birds, flowers, running brooks and trees. It is curious to note that the name of Vogelweide, which means "bird-meadow," was probably adopted by the boy because of his love for nature. There is also a wood called by the name of Vogelweide, which might have suggested the name to him.

As a young man Walther went to Vienna and lived at the court of Duke Friedrich. There he learned to sing and write poetry, but unfortunately Friedrich soon died, and the new duke did not care for the poet. Consequently Walther left Vienna and became a traveling singer, journeying from one royal court to another, composing and singing his works. His manner and his gentle birth gained for him access to all the courts, and his beautiful songs of religion, love and chivalry were joyfully welcomed everywhere. His travels took him from Hungary to France and from northern Italy to the Baltic Sea. At the home of the landgrave of Thuringia Walther spent a considerable amount of time. The duke appreciated the young man's work, and upon his advice had a singing contest at Wartburg. All the minnesingers, or bards, came from far and near to sing in the match. All children ought to hear Richard Wagner's famous opera Die Meistersinger (The Mastersingers) which is based on the incident of the song contest in Walther von der Vogelweide's life.

The poet was also a great patriot, and in the frequent struggles between the pope and the emperor, Walther sided with the emperor. After singing for more than forty years, the bard died, about 1230, and was buried at Wurzburg. His grave is under a huge tree, the spreading branches of which cast a shade over the tomb of the "Swan of Germany." According to his wish, there is always food provided for the many singing birds that live in the tree.

As time went on, and the Crusades colored the whole mind of Europe with the magic and wonder of the East, these songs became monotonously chivalric and tiresomely incredible, till the glee-men turned to love for a new subject, and composed such love-sick songs that another reaction came, for the love-songs became coarse and base. Then the noblemen threw these wandering minstrels out of their courts, and revived a scholarly song of romantic love which reigned over German literature till the stormy days of Martin Luther.

BRIGHT SPOTS IN THE DULL LITERATURE OF THE REFORMATION

With the Reformation literature became almost exclusively religious, and a

very dull literature it was; but there were two splendors of that time—Luther's translation of the Bible into German, and some magnificent German hymns.

Let us see how the Reformation influenced the literature of those buffeted and stalwart German peoples who fought for religious freedom in the midst of a continent bitterly hostile to their genius.

For years German literature took a moral tone. It was a literature of building up. The Roman Church, like the Roman Empire, was broken, and a new civilization had to take its place. All the best minds in Germany set themselves to the difficult task of giving men higher ideals, a sterner code of conduct, a more unflinching spirit of realism. Biblical plays became popular. Terrible satires against the priesthood were gradually supplanted by Scriptural dramas. There were twenty-four versions of the story of the Prodigal Son. Hans Sachs, a shoemaker, became the principal playwright and the great mastersinger of his time, leaving the Bible to take care of itself, and giving to drama and song a moral note not unlike that of Bunyan, and a gentle realism not unlike that of Chaucer. He was, and is, a great figure in the history of German literature.

THE DULL BOOK OF A LUTHERAN PASTOR WHICH INSPIRED THE IMMORTAL FAUST

But the real note of religion was sounded at this time by the German mystics, both Protestant and Catholic, who made a tender and beautiful attempt to detach the mind of man from earthly illusion and woo it into the region of meditation and spiritual desire. Greatest of these, perhaps, was Jacob Böhme, whose works are still read in many languages.

In 1587 a Lutheran pastor produced Doctor Johann Faust. This famous book was simply a collection of tales about a man who had died some fifty years before, and was written solely to warn people about magic. It is a moral book, very dull and stupid, but it was destined one day to inspire a supreme genius with an idea which has now become the property of the human race.

It is a sad thought that Germany, the home of the Reformation, should have had no share in the glorious awakening (the Renaissance) which flourished in almost every other country. War had so devastated her land that there was no youth in her poetry. A Silesian named Martin Opitz strove to create enthusiasm for the German language, and gathered about him a number of faithful disciples; but their poetry and prose lacked altogether the spirit of immortality. Paul Gerhardt alone stands out as a singer of power and originality, and he was a hymn-writer.

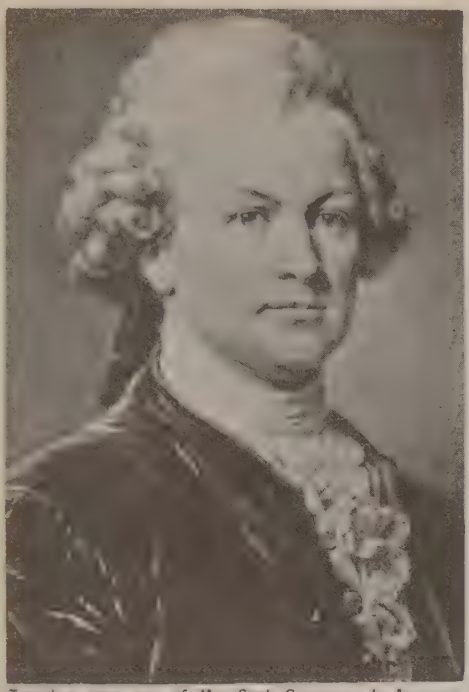
THE STORY OF A STIRRING STRUGGLE BETWEEN GOOD AND EVIL

But presently a book, of which the author was not known for a hundred and fifty years, awoke Germany to a new feeling for literature. It was called *Der abenteurliche Simplicissimus* (The Adventurous Simplicissimus), and, unlike all romantic stories of knights and heroes, it tells the tale of a vagabond. "Instead of pages, lackeys and hostlers," says Simplicissimus, "my sire had sheep, goats and pigs, each dressed elegantly in his own natural livery; and they often waited upon me in the chase until I drove them home."

The boy runs away and becomes a soldier; he commits all sorts of crimes, but is always hankering after something better. The book is the story of a soul that cannot make up its mind to be good or bad. The author turned out to be a man named Grimmelshausen.

From Simplicissimus we pass to Frederick, called the Great, and the first literary figures we encounter under the amazing reign of that Prussian king who despised German literature are those of Klopstock and Wieland. Klopstock, who lived from 1724 to 1803, decided to provide Germany with a Milton, and sat down to write The Messiah. He failed in his ambition, but he did free the German soul from the pedantry which had for so long reigned over its literature. Wieland, living from 1733 to 1813, struck a blow at the mystery with which Klopstock sought to invest the poet, and contributed to a greater freedom in German literature. He began by being a poet of Christianity, but rather changed his tone and gave great offense to his former admirers by the freedom with which he wrote of life. His chief service was to win German attention from translations to their own literature, and his name, for this reason, will always hold a great place in the history of his people.

We shall next speak of Gotthold Ephraim Lessing, who lived at about the



Lessing was one of the first Germans to become interested in the writers of other lands. He began to study theology, but could not keep away from the theatre. He wrote plays.

same time, in this, the most productive period of German literature.

GOTTHOLD EPHRAIM LESSING, DRAMATIST, CRITIC AND POET

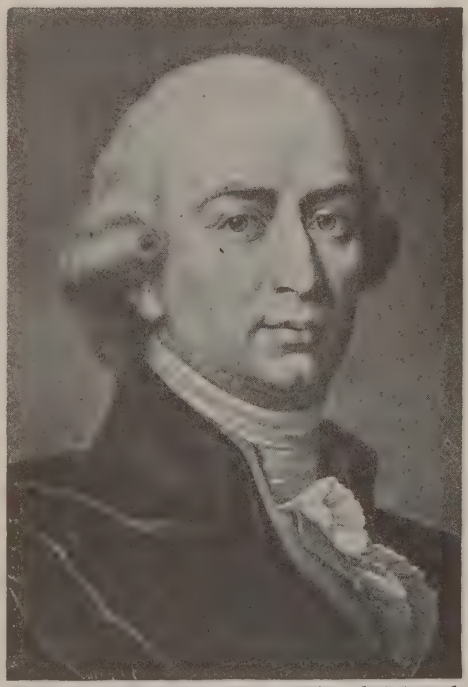
At Kamenz, in 1729, was born the first great German man of letters. By a man of letters we mean one who is interested in many different kinds of literature. At the age of seventeen Lessing went to Leipzig to study theology, expecting to become a minister, as his father was. When he arrived at the university he discovered that other things interested him more than preparing for the pulpit. He felt ignorant of social forms and therefore took up horseback-riding and fencing, and in other ways set about acquiring the style of a Saxon gentleman.

While with his cousin he met several dramatists and actresses and became very much interested in the stage. His father highly disapproved of his associating with actresses, who at that time were not received in refined society. He called his son home, but allowed him to return to Leipzig upon the promise that the young man conscientiously study medicine.

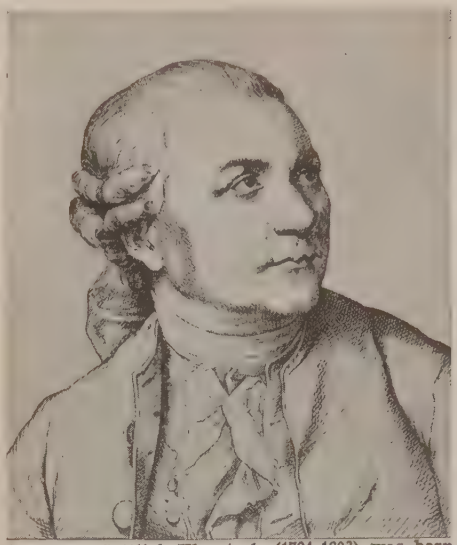
Lessing could not keep away from the theatre, and became acquainted with Frau Neuber, who managed a small theatre. She produced his play *Der junge Gelehrte* (The Young Scholar) in 1748, and thenceforth Lessing devoted a great part of his time to the writing of drama. The Neuber company disbanded soon after, and Lessing migrated to Berlin to try his fortune. Besides writing for the newspapers, he studied the Greek and Roman classics and read many Italian, Spanish, French and English books.

His first work of importance was Miss Sara Sampson, a play written in 1755. The most noteworthy part of this drama was the fact that the characters were ordinary folk—not kings and queens, the usual subjects for plays. Miss Sara Sampson was unique in that it departed from the French type, which the German writers most frequently used. The Seven Years' War developed a new patriotism in Prussia, and consequently the play Minna von Barnhelm was written.

Lessing studied and revived Greek literature and art in Germany. He believed that the Greeks were the final authorities in matters of art, and in 1766 his Laocoön was published. This made



Herder attempted to study medicine, but turned to theology and then to the study of languages. He spent the last years of his life at Weimar, which was also the home of Goethe and Schiller.



Friedrich Gottlieb Klopstock (1724–1803) was born at Quedlinburg, the eldest son of a lawyer. He died at Hamburg, mourned by all Germany.

the writer one of the foremost of European critics. In *Hamburgische Dramaturgie* (The Hamburg Dramaturgy), Lessing again displayed his remarkable ability as a critic. The writer's greatest work was written two years before his death in 1781. It was a drama in verse called *Nathan der Weise* (Nathan the Wise). The play attempts to show that noble people may be found in all creeds.

THE WRONGS THAT WERE FORGOTTEN IN THE GLORY OF THE RIGHT

With Lessing came the teacher and preacher Johann Herder, who lived from 1744 to 1803. Herder attacked Lessing here and there, and first proclaimed to the German mind that it was grotesque to judge so gigantic a genius as Shakespeare by the fussy little rules of French tragedy.

He compares Shakespeare's plays to a surging sea, and suggests that passion is the utterance of genius. He reminds us of Carlyle. All the people about him were talking of light, and he shouts out that men cannot live on light. Repose and luxury, he says, are the enemies of a great destiny. The sneer of Voltaire wears itself off the face of mankind. He looks back to the Middle Ages and cries out: "Give us back your reverence and superstition, your darkness and ignorance, your disorder and rudeness of manners; and take in return our light and our unbelief, our nerveless coldness and refinement, and our human wretchedness."

Herder was born at Mohrungen, in East Prussia. His parents were very poor, and only by sacrificing themselves were they able to allow the boy to study medicine. He soon discovered that he could never become a physician because it made him ill to witness an operation. Abandoning the study of medicine, he went to Königsberg and studied theology. He then settled at Riga as teacher and preacher. Herder took a great interest in French, German and English literature. He did not neglect the Bible, and after making a careful study of this book discovered some things about the history of religion which had been unnoticed.

In 1767–68 Herder published *Fragmente über die neuere deutsche Litteratur* (Fragments on Recent German Literature). Up to this time people believed language was a gift sent from Heaven and that God had given each country a different language. The author showed that the primitive peoples expressed their emotions of fright, fear and admiration by high-pitched sounds and violent gestures. With increasing knowledge fear and admiration were softened and man became more familiar with his surroundings. Finally the very surroundings had an influence upon the sounds he made, and in this way the different languages were evolved.

Herder also believed that poetry was

Heinrich Wilhelm von Kleist, German poet, dramatist and novelist, was born at Frankfort on Oder on October 18, 1777.

the natural way of expressing feelings, because in his study he discovered that poetry had reached a high point before we have any record of prose writings. In his advice to his countrymen Herder suggests that instead of imitating the Greeks they try to be original, so that Germany may have a literature of its own.

In 1778 was published *Stimmen der Völker* (Voices of the Nations in Song), a splendid collection of folk-songs. This was the first collection of folk-songs made by a German. Herder died in 1803.

HEINRICH WILHELM VON KLEIST, POET, DRAMATIST AND NOVELIST

This poet, dramatist and novelist was born at Frankfort on Oder in October, 1777. Heinrich von Kleist was a poor Prussian nobleman who joined the army when very young. He retired as a lieutenant and endeavored to continue his neglected studies. The young man began bravely enough and pursued his ideal of culture. Study, however, soon tired him, and he decided to travel in search of peace of mind. This writer was very morbid; he believed that everyone wished to harm him and that his relatives and friends were untrue. During his travels Kleist met Goethe and Schiller. He believed that he was far greater than Goethe and is quoted as saying: "I will soon snatch the crown from the head of Goethe." The great author sympathized with the strange young man and said that Heinrich von Kleist seemed to him like a human form beautifully made by nature and afflicted with an incurable disease.

Kleist became engaged to a young lady, and decided to live on a farm in Switzerland. She, however, did not approve of this and immediately broke the engagement. The young man lacked self-confidence, and this, combined with his morbid nature, was disastrous.

His first work was *Die Familie Schroffenstein* (The Schroffenstein Family), a tragedy in verse very much like Shakespeare's Romeo and Juliet. Between the years 1806 and 1808 two remarkable dramas appeared—Penthesilea, and *Das Kätchen von Heilbronn* (Kathie of Heilbronn). He also published a comedy, *Der zerbrochene Krug* (The Broken Jug) and several other plays. In 1808 Kleist wrote a novel, Michael Kohlhaas, which deplores the injustice of the laws of Germany at the time when Kleist lived. He saw that the only way to have proper government was to unite all the small principalities under one ruler. He shows the advisability of this in his plays *Die Hermannschlacht* (Hermann's Battle) and Kathie of Heilbronn.

The poet was offered a commission in the army in 1811. He needed a uniform and decided to borrow the money for it from his relatives. Having already frequently supplied him, his family refused to give any more money. He became very despondent and entered into a death compact with a musician, Frau Henriette Vogel. He shot her and then took his own life.

We now turn from Kleist to a man who in many ways was his opposite. We have been speaking of an eccentric genius of noble family, and next we have a simple man of the people, who knew no greater joy than that of listening to the students singing his songs.

LUDWIG UHLAND, ONE OF GERMANY'S MOST POPULAR SONG-WRITERS

Ludwig Uhland was born in Tübingen on April 26, 1787. He was a son of a Swabian professor and studied in the university of his native town. Even his early songs showed a remarkable simplicity and a depth of feeling. His most popular poems are: *Droben stehet die Kapelle* (Yonder on the hill's the chapel), *Ich bin vom Berg der Hirtenknab'* (The highland shepherd boy am I), *Wir sind nicht mehr am ersten Glas* (The first glass now has gone the round) and *Das Schloss am Meer* (The Castle by the Sea). This last poem is contained in the Book of Poetry. The most productive period of Uhland's life came at the time when Germany was struggling against Napoleon.

No poet knew better how the common man feels than he, and this is well illustrated in *Der gute Kamerad* (The Good Comrade) and *Der Wirtin Töchterlein* (The Landlady's Daughter). Uhland also wrote many ballads. The most popular are: *Klein Roland* (Childe Roland), *Des Sängers Fluch* (The Minstrel's Curse) and *Das Glück von Edenhall* (The Luck of Edenhall). Next to Schiller, Uhland is the most popular of all German poets. Although he did not write a great deal of poetry, most of what he did write is popular to-day, and many of his songs have been set to music. He died in 1862.

THE NEXT STORY OF LITERATURE IS ON PAGE 6409.

ATTRACTIVE NORTHERN FLOWERS

The Showy Cypripedium is by many thought to be the most beautiful of the lady's slippers. Its large, white flowers usually bloom in June and July.

Dutchman's Breeches is an April flower. Its lovely heart-shaped white and yellow flowers spring from clefts in rocky cliffs. It has thrice-compound leaves.

The Large White Trillium shown in this picture is the most beautiful of the Trillium Family. It fills the northern woods with its starry white blossoms in May. Farther south the blossoms come earlier.

The flowers of the Skunk Cabbage make their appearance before the green leaves. They are hidden by a purplish spathe that curls round them. The plant has an unpleasant odor, whence the name.

FLOWERS OF NORTH AMERICA

YOU have been told that the same flowers do not grow in every part of even a small country. Because of differences in the amount of heat and moisture, in height above the sea, in the kind of soil, flowers which are common in one place may be rare or unknown a hundred miles away. In a continent like North America with great differences in climate and altitude there are many different plant zones in which the plants are quite different. On the other hand, some plants are able to live in several zones. For example, you will find many eastern plants in the South. We shall divide North America into four regions, the East, the South, the Middle West and the Pacific.

FLOWERS OF NORTH AMERICA

FLOWERS OF THE EAST: PART I

CONTINUED FROM 6131

FLOWER in the crannied wall,
I pluck you out of the crannies,
Hold you here, root and all, in my hand,
Little flower, but if I could understand
What you are, root and all, and all in all,
I should know what God and man is.
—TENNYSON.

"Spring begins," says Burroughs, "when the partridge drums, when the hyla peeps, when the shad starts up the rivers and the grass greens in the spring runs; and it ends when the leaves are unfolding and the last snowflake dissolves in midair."

Over four thousand flowering plants have been found in this region. Of those only the most common ones will be described. Fortunately plants occur in families and show striking family characteristics. This helps us much in our desire to know by name our floral neighbors.

LOOK UP FOR THE FIRST FLOWERS TO THE FOREST TREES

In the spring the motto of all flower-lovers should be, "Look thou not down, but up," for the trees are the first to present their flowers. Long before the snow has disappeared, the "pussies" on the willows have burst their purplish brown winter jackets and presented their velvety gray catkins, which form a charming contrast to the reddish twigs. Some gray catkins become yellow, and bear the pollen, which is carried to the silvery green pistillate catkins by wind and insects. The pistillate catkins remain after the leaves of the tree have unfolded, and ripen their seeds, which are carried away by wind. The Poplars belong to the Willow Family, and, like the Willows, send out gray, downy tassels before the leaves open. Birches also bear catkins, which appear in the early spring. Birch catkins are very pretty. They are long, graceful, of a silky softness, and with a rich golden color.

THE BLOSSOMS OF CANADA'S OWN MAPLE TREE

Most Maples blossom early. Even in April the Red Maple is covered with tiny red blossoms. These, with the red twigs, give the tree a striking appearance, in contrast with the white snow which may not have disappeared. The Silver Maple has yellow flowers, and the Rock, or Sugar, Maple, the national tree of Canada, sends out greenish yellow flowers on slender hairy stalks, in graceful, drooping clusters appearing a short time after the leaves have unfolded. The Basswood, or American Linden, blossoms in May. Its fragrant honey-bearing flowers appear in clusters hanging from the centre of a narrow leaf-like bract. This bract later serves as a float to the round one-seeded fruit.

The Elm is a popular tree in the East. It grows to a great height, with

drooping branches, and in general shape is like an inverted cone. For lining streets, and to lend grace to any landscape, it is one of the most charming of our trees. Before the leaves have opened, the flowers, on slender, drooping stalks, fringe the sides of every branch. The fruit is one-seeded and is surrounded by a thin wing, which serves as a float. The fruits drop early, and in June can be gathered in great quantities.

SOME OTHER FLOWERS OF THE FOREST

The Oaks, Beeches and Chestnuts also blossom early. The Horse-chestnut, though not so common in our woods as oaks and beeches, has beautiful flowers, which appear during the latter part of May. In winter each twig ends in a bud one inch or more long, and within the scales of this bud are borne the leaves and flowers of the coming year. When the warmer days of spring come the resinous scales of the bud drop off, and the leaves—tiny downy green babies done up in woolly blankets—appear.

The Gray Hoss-Chestnut's leetle hands unfold,
Softer'n a baby's be, at three days old.

The white flowers are very attractive, and appear in large erect clusters resembling the flower-cluster of the common lilac. The native broad-leaved trees of America are beautiful in midsummer, and sometimes we think particularly so in their autumn tints of yellow and red, but the charm in early spring is great when

The saffern swarms swing off from all the willows,
So plumb they look like yaller caterpillars.

THE FIRST FLOWERS OF THE EARLY SPRINGTIME

If one is bold enough to venture into swampy places in the leafless woods in March, he may find the purple-mottled, sharply pointed spathes of the Skunk Cabbage. The young buds pushed their way upward before the winter set in, and Thoreau advises those afflicted with melancholy to go to the swamps and see the brave spears of skunk cabbage already advanced toward a new year. The purplish shell-like leaf that curls about the tiny flowers, which are hidden from view, is not attractive, and the whole plant, as its name implies, possesses an unpleasant odor, so that while we admire its bravery, we shall not be inclined to gather it. The large beet-shaped leaves, which grow to a length of from one to two feet, appear later than the spathe and flowers, and help to mark the wet woods with bright patches of rich foliage. It has been said that bears greatly relish this early green, and settlers near Philadelphia gave to the plant the name Bearweed. One writer remarks that "it must have been a hot morsel, as the juice is acrid, and is said to possess some narcotic power, while that of the root, when chewed, causes the eyesight to grow dim."

THE SWEET-SCENTED TRAILING ARBUTUS, OR MAYFLOWER

Though quite unlike the skunk cabbage in every respect, the Sweet-scented rosy-lipped Mayflower, or Trailing Arbutus, appears in April or early May locally among damp and withered leaves, in sheltered hollows, under trees or in little dells. It has been described as

Pink, small and punctual,
Aromatic, low.

The stem has rusty hairs, and is prostrate or trailing. The leaves are rounded, heart-shaped at the base, and evergreen. The fragrant pink waxy flowers are hidden in little clusters beneath the leaves. Because of their delicious fragrance and rich store of honey the flowers are much sought after by both man and bees. There is the pretty story that the Mayflower was the first flower to greet the Pilgrims at Plymouth after their fearful winter, and give them a promise of better days to come. Whittier says:

Yet God be praised! the Pilgrim said
Who saw the blossoms peer
Above the brown leaves, dry and dead,
Behold our Mayflower here!

OTHER FLOWERS THAT GLADDEN THE EARLY SPRING DAYS

Coltsfoot is found in April. It is an immigrant from Europe, but is now wild in this country. It has a slender scaly scape from three to eighteen inches high, which bears a solitary yellow flower-head that somewhat resembles a dandelion. It has both ray and disk flowers. The leaves appear later than the flowers, are heart-shaped below, lobed and woolly beneath. It is found growing in most ditches and along the banks or in the beds of streams, where the bees seek it out for the honey from its flowers.

Soon after the late snow has melted
The Liver-leaf puts forth her sister blooms
Of faintest blue—

In the woods in early May we may find the fragile-looking, emerald-like flowers of Liver-leaf, more commonly called Hepatica. The flowers are white, pink or blue, and less than one inch broad. Each flower is borne on a fuzzy scape. The leaves are rounded and three-lobed, and the rusty brown leaves of the previous summer remain over winter, and afford a pleasing background for the delicate flowers.

In April or May we look for the Spring Beauty, which, like hepatica, opens in the sun and closes in the shade.

> So bashful when I spied her,
> So pretty, so ashamed!
> So hidden in her leaflets
> Lest anybody find.

Though not much "hidden in her leaflets," the flowers of spring beauty, which is also called Claytonia, are very pretty. They are white with pink veins, or pink with deeper colored veins, and grow in a loose cluster. Deep down beneath the ground is a small round swollen stem, or tuber, which in early spring develops into a long slender aerial stem bearing two grass-like leaves opposite to each other. At the top is the loose cluster of flowers. It is found in moist open woods in many parts of Canada and the United States.

Bloodroot, which the Indians used to paint their faces

In April the curled-up leaf of Bloodroot, wrapped in papery bracts, pushes its firm tip through the brown leaves, and soon presents a white or rose-tinted flower borne on a naked scape. The foliage leaves are round and deeply lobed. The flowers are beautiful, but the snowy petals quickly fall from about their golden centre, and in two or three days the loveliness of the flower is gone. The plant receives its name because of the crimson juice of its rootstock. The red liquid which oozes from the wounded stem when the flower is picked stains the fingers. The crimson juice was much prized by the Indians for use in decorating their faces and tomahawks, and in some places it was called Red Indian Paint. The plant grows in eastern Canada and the United States. It is a member of the Poppy Family.

Dutchman's Breeches has thrice-compound leaves, and white and yellow flowers growing in a raceme on a slender scape. Each flower is heart-shaped, with two bracts or small leaves near its base, two scape-like sepals, four somewhat cohering white petals tipped with yellow and six stamens in two groups. The two outer petals are large, with spreading tips and deep spurs; the two inner are small, with spoon-shaped tips uniting over the anthers and stigma. The underground stem consists of little grain-like tubers collected into one mass, which resembles a bulb.

The pretty yellow squirrel corn

Squirrel Corn very much resembles Dutchman's breeches. Its underground stems bear scattered yellow tubers resembling grains of corn. Its graceful clusters of nodding flowers have the fragrance of hyacinths. Both are found in rich woods.

In April the seams of rocky cliffs and hillsides begin to whiten with the blossoms of Early Saxifrage. The leaves are clustered at the root. On a scape from four to nine inches high are borne the small white flowers in clusters. The calyx is five-cleft, and the corolla has five petals, and there are ten stamens. When ripe, the seed-pods have a rich madder-brown tone, which gives a warm color to the rocky slopes on which the plants grow.

Our seasons vary from year to year, but usually the same flowers are found in blossom at the same time. When you find the liverwort, you may look for the bloodroot and the adder's tongue, the trillium, and soon the spring beauty, the anemones and the violets. In many places the blue violets cover the ground with a sheet of dainty violet tinge.

A beautiful flower with two ugly names

The Yellow Adder's Tongue, a member of the Lily Family, though often called the Dog's-tooth Violet, sends up a one-flowered scape from six to nine inches high. Surrounding the scape at its base are two oblong lance-shaped leaves, which are pale green, mottled with purple and white. The nodding flower, with a perianth of six pale yellow parts marked with purple, resembles a small lily. The two names which the plant bears are inappropriate. Mr. Burroughs has suggested "Fawn Lily" or "Trout Lily"—the first name because the two mottled leaves stand up with the erect, startled look of a fawn's ears; the second because of its speckled foliage, and because it appears when the fever for trout-

fishing seizes many people. It grows in those hollows in the woods where the early May sunlight filters through the still, leafless branches of the budding trees.

THE WIND-FLOWERS OF THE MAY TIME

Bryant writes:

> . . Within the woods,
> Whose young and half transparent leaves scarce cast
> A shade, gay circles of anemones
> Danced on their stalks.

And Whittier tells how these

> . . . wind-flowers sway
> Against the throbbing heart of May.

The Wood Anemone, or Wind-flower, has a simple slender stem, three petioled leaves, each with three wedge-shaped leaflets, and a solitary white, pink or purplish flower of from four to seven petal-like sepals. Our wind-flower seems to us an emblem of spring and purity; but to the ancient Persians it was an emblem of sickness, because it was believed that the wind which had passed over a field of anemones was poisoned, and that disease followed in its wake. The Rue Anemone has leaves with rounded leaflets and white or pinkish clustered flowers. The two anemones blossom at the same time, but the rue anemone lingers after the wood anemone has finished blooming.

THE GAY TRILLIUMS WHICH ADORN THE WOODS

The Trilliums are among the most attractive May flowers. There are three common ones, the white, the purple and the painted. The large White Trillium, or Wake-robin, is without a rival in purity and abundance. It fills rich woods in Eastern America, and lends a distinctive charm to the landscape, as its great white stars stand out from shaded wood borders or from the banks of swift-flowing streams. From a stout rootstock arises a stem bearing a whorl of three green leaves. The flower is terminal, and has a calyx of three green sepals, a corolla of three long pointed white petals, six stamens, and a pistil of three stigmas. The ripened fruit is a dark purple berry, ovate and somewhat angled. The flower is beautiful, but without perfume or nectar. Unhappily these beautiful flowers have almost been exterminated in some sections of the country, particularly near large towns. Careless hands pull up the plants, without a thought of seed or root for the flowers of coming years.

The Painted Trillium is not so large and showy. Its three white petals are painted at their base with red stripes. The so-called Purple Trillium has a stout stem, with a whorl of three broadly ovate leaves a short distance below the solitary terminal flower. The calyx consists of three green spreading sepals, and the corolla of three large lance-shaped pinkish petals. It is a hardy harbinger of spring, but the name Wake-robin, which it bears, is not appropriate, because the robins have usually been about and on the alert several days before our flower unfurls its crimson signal.

VIOLETS—BLUE, PURPLE, WHITE AND YELLOW

Among the most popular of all spring flowers are the Violets, in yellow, white and blue. Over forty species have been observed in America, and they are found flooding the swamps, fringing the hills, and lurking in shady nooks on the hillside, from the Atlantic to the Pacific. The common Blue Violet, with its slender one-flowered scape, its heart-shaped leaves, and its pale blue to deep purple flower, is perhaps the best known and the most beloved of all. The five petals of the corolla are somewhat irregular, and the lower one is spurred at the base.

> . . . purple violets lurk,
> With all the lovely children of the shade.

There are many species of blue violets. An interesting feature in connection with violets is that many of them have hidden flowers, where self-fertilization takes place, and the seeds are ripened in the dark near or beneath the ground. One species is called the Canada Violet. It has white petals veined with purple and violet beneath. Its delicate flowers are fragrant, and it is among the loveliest of the family. The Sweet White Violet, the most fragrant of the violets, has small white flowers daintily veined with brownish purple, and is found in low wet woods. The Downy Yellow Violet has an erect leafy stem, broadly heart-shaped toothed leaves, and yellow flowers veined with purple.

> The yellow violet's modest bell
> Peeps from the last year's leaves below.

In late April and early May our wet meadows are brightened by the golden yellow flowers of the Marsh Marigold.

SPRING FLOWERS OF NORTHERN WOODS

The Hepatica is one of the best known of our spring flowers, and one of those that the children love best. It blooms in our northern woods in early May.

The Adder's Tongue, which also blooms in early May, is a member of the Lily Family. Its tall, lily-like flower is pale yellow marked with purple.

The Bloodroot gets its name from the crimson juice of its rootstock. It is also called Indian Paint, because the Indians used the root juice to paint their faces. The flowers are white or rose-tinted.

The Bellwort is another member of the Lily Family. The leaves of the plant clasp its graceful, curving stem, and under them hang the pale yellow drooping flowers. It is abundant in the spring woods.

This name was given it because the early English settlers in America thought it identical with Shakespeare's Mary-buds.

> And winking Mary-buds begin
> To ope their golden eyes.

Others, dreaming of home, called it Cowslip, and that name still clings to it. The leaves are rounded and somewhat kidney-shaped, with several growing from the base of the stem, which is furrowed and hollow, and bears above several flowers which have no corolla. The flower is made up of from five to nine golden yellow petal-like sepals, with numerous stamens, and from five to ten pistils, which ripen into little seed-pods. The flower produces much pollen and an abundance of honey, and is therefore much visited by bees. It is common in Canada and the United States, and is so abundant along certain English rivers as to cause the ground to look as though paved with gold.

TWO FLOWERS THAT HAVE BITTER ROOTS

Another dweller in marshy land is Jack-in-the-pulpit, or Indian Turnip. There are generally two leaves on long leaf-stalks, and each is divided into three leaflets. Terminating a scape is a hood-like leaf, or spathe—the pulpit—which is light green, veined with a deeper tint and stained with purple. Inside the spathe are the small, inconspicuous flowers packed about the lower part of a fleshy spike. The flowers are without calyx or corolla, and are of two kinds: the one composed of several united anthers, the other of a single pistil with a bush-like stigma. The two kinds of flowers may be on the same spadix or on different ones. If on the same spadix, the pistillate flowers are at the base and ripen into bright scarlet berries packed upon the spadix. The Indians boiled these scarlet berries and ate them with great relish. Later they discovered that the fleshy bulb-like base of the stem, called a corm, in which is stored the food for next year, lost its stinging taste when cooked, and made nutritious food—hence the name Indian Turnip. It is a favorite schoolboy trick to tempt others to bite into the raw, blistering corm. The impression made on the tongue is not soon removed, and the second bite is not often taken. It is a cousin of the skunk cabbage and sweet flag, and the taro root of the Pacific Islands also belongs to the same family.

The underground stem (rootstock) of Wild Ginger, which sends up its shy, dull purplish brown solitary flowers in May, has a ginger-like flavor, and by the early settlers was considered a remedy for headache and deafness. It sends up one or two kidney- or heart-shaped fuzzy leaves on long stalks, and the tiny flower lies close to the ground on a short stem from the fork of the leaves.

BELLWORT AND STAR FLOWER

Bellwort, a member of the Lily Family, is very abundant in the woods in early spring. It has a graceful curving stem about eight inches high, several lance-oblong pale leaves set close to or clasping the skin, and beneath the leaves one or two modest lily-like yellowish or straw-colored drooping flowers. It is common over the eastern half of America.

Much resembling the anemone, but belonging to a different family, is the Star Flower, or the Star Anemone. It has a slender erect stem, bearing at the summit a whorl of from five to ten thin pointed leaves; and above the whorl of leaves, borne on a short petiole, is a white delicate star-shaped flower with seven divisions. The whole effect of plant, leaf and blossom is starry and pointed. The flower secretes no honey, but it is visited by small bees searching for pollen, which is thus transferred from one flower to another and cross-fertilization is brought about.

GOLD-THREAD, A FLOWER OF THE BOG LANDS

A beautiful little plant, whose shining three-parted evergreen leaves carpet swampy bogs throughout the year, is the Gold-thread, which has received its name because of its golden yellow thread-like roots. Its delicate white flowers, with from five to seven club-shaped petals and numerous stamens, are solitary on slender scapes from three to five inches high. The pistil consists of from three to seven parts, which ripen into divergent pods, borne on slender stalks, and bearing long, tapering styles. Gold-thread is one of the best known of all our wild flowers because of its beauties and its uses. A wash from its bitter yellow roots is used for ulcerated throats; and the plant is regarded by some people as an excellent tonic. The Indians

used the roots to make a yellow dye for their clothes and paint for their faces.

BERRIES WHICH ARE AS ORNAMENTAL AS FLOWERS

White Baneberry is a common plant in cool, shady nooks near streams from the Atlantic to the Pacific Ocean. The stem is about two feet high, the leaves are twice- or thrice-compound with incised and sharply toothed leaflets, and the flowers are very small, and borne in thick oblong terminal feathery clusters. In midsummer the fruit is a very conspicuous feature of the woods. The flower-clusters have given place to a cluster of oval white berries, each with a dark spot on it and each borne on a thick red stem. The berries are not edible. An earlier species, the Red Baneberry, blossoms a week or two sooner. It produces cherry-red berries borne on slender stems. Curious variations, probably due to intercrossing of the species, are found in the fruits of these plants.

THE WILD COLUMBINE, WHICH LOVES THE ROCKY PLACES

Emerson said:

A woodland walk,
A quest of river grapes, a mocking thrush,
A wild-rose or rock-loving Columbine,
Salve my worst wounds.

The Wild Columbine is from one to two feet high, with branching stems bearing many much-divided leaves with lobed leaflets, and large nodding attractive flowers of five brightened petal-like sepals and five petals in the form of large hollow spurs which are red without and yellow within.

The graceful Columbine all blushing red,
Bends to the earth her crown of honey-laden bells.

The flowers contain much nectar, which is eagerly sought by bees and hummingbirds. The many stamens and the long styles of the five pistils project from the flower as a delicate golden fringe. Many species and varieties of Columbine in different colors, such as blue, purple and white, are cultivated, and these sometimes escape and grow wild in some parts of the country.

THE FOAM-FLOWER AND THE BISHOP'S CAP, MITERWORT, TRUE AND FALSE

In rocky woods and on hillsides in early spring the beautiful clusters of Foam-flower, or False Miterwort, are found. The stem is from five to twelve inches high and is usually leafless, with one or two heart-shaped sharply lobed leaves growing at the base from the underground stem. The foamy white flowers, each with a five-parted calyx, five petals on claws, and ten long and slender stamens, are borne in a cluster at the top of a slender stem rising about eight inches above the ground. The seed-pod has the form of a bishop's cap or crown, hence the generic or family name *Tiarella*, meaning "turban" or "crown."

In rich woods, but blossoming later than the foam-flower, is found the True Miterwort, or Bishop's Cap. The raceme is more slender and open, and the few flowers are smaller, more delicate and crystal-like. Both species are common in eastern Canada. Another species of miterwort, blooming at the same time, and common in swamps from the Atlantic to the Pacific, has long slender runners, from which are produced rounded or kidney-shaped leaves with deep round teeth, and a clothing of soft hair. The flowers are small and greenish, and are arranged in a loose cluster at the top of a slender stem.

A PLANT WHICH HAS NEVER GAINED A COMMON NAME

Clintonia borealis, a beautiful plant without a common name, but usually called Clintonia, shows its three or four dark green shining leaves sheathing a stem at its base, at all times in summer. In May or June it sends up a scape from four to eight inches high, bearing a cluster of drooping greenish yellow bell-shaped flowers. Each flower has a perianth of six colored sepals, six protruding stamens and one pistil—a member of the Lily Family. Later in the season the cluster of flowers gives place to a cluster of blue oval berries, which are beautiful in contrast with the rich green foliage which carpets the woods.

Toothwort is a pretty spring flower common in rich, moist woods. It has other common names, such as Crinkle-root and Pepper-root, descriptive of the pleasant, pungent flavor of its wrinkled toothed rootstock or underground stem, which is crisp and edible, and used to flavor many a simple luncheon in the cool shadows of the forest. The stem is leafless below, but bears above two leaves, each divided into three toothed leaflets. The flowers are white, in a terminal cluster. Each flower has four

sepals which drop off early, four white petals and six stamens, of which two are shorter than the others. These are characteristics of the Cress Family, which belongs to the same order as cabbages, stocks and sweet alyssum.

SOLOMON'S SEAL, AND ITS IMITATION

Any story of common spring flowers would not be complete without a reference to Solomon's Seal, the blossoms of which appear in May. The stem is slender, curving, and from one to two feet long. The leaves are alternate, oval, and set close to the stem. The yellowish bell-shaped flowers, singly or in twos, nodding from the axils of the leaves, are fastened to a slender flower-stem so fixed into the axil of the leaf that the flowers droop beneath each in a graceful curve, which is sustained in later summer by the dark blue berries. The rootstocks are marked with large round scars somewhat resembling the impression of a seal upon wax, and this suggested the common name.

Wild Spikenard, often called False Solomon's Seal, is a handsome and common plant in some localities. It resembles the true Solomon's seal only in the leafy stem, which is usually curving and from one to three feet long. The flowers are greenish white, small, and in a terminal raceme, at the end of the leafy stem. The leaves are large, oblong, veiny, and clasp the stem alternately. The fruit is a pale red berry speckled with purple, and the clusters of ripe berries are found in the late summer months.

Another member of the Lily Family, which flowers in May and June in moist woods is the so-called Canada Mayflower. It has a cluster of small white flowers rising just above two clasping, broadly ovate leaves.

TWISTED STALK AND CELANDINE

The Twisted Stalk somewhat resembles Solomon's seal, with which it is found blossoming in the woods in May and June. The stem is rather stout and zigzag, and bears taper-pointed, slightly clasping leaves. The whole plant presents a graceful group of forking branches and pointed leaves; and on picking up a branch one finds beneath each of its outspread leaves one or two slender bent stalks, from which hang the dull purplish pink bell-like flowers. In autumn it bears round red berries.

> There's a flower that shall be mine,
> 'Tis the little Celandine.

Thus wrote Wordsworth of a plant with golden yellow clustered flowers, each with two sepals, which fall early, four petals and sixteen or more stamens. The stem is brittle, and gives a saffron-colored acrid juice when broken. The leaves are much divided, and the seed-pods are long and slender. Celandine is a European plant now common on roadsides in eastern Canada. In Europe it is called Swallow-wort, because it is supposed to commence flowering when the swallows come and cease when they depart.

THE PRETTY FEATHERY FLOWER OF THE BUCK-BEAN

In May or early June we are tempted deep into the long grass of a swamp by the beautiful white flowers of Buck-bean. The flowers are clustered along the upper part of a scape about one foot long. Often they are reddish before opening. The calyx is five-parted and the corolla is five-cleft, funnel-form and fringed on the upper surface with a white beard, which gives the flowers a beautiful feathery appearance. The leaves are long-stemmed, and each is divided into three oblong leaflets. The Wild Bean, or Ground-nut, which blossoms in late summer, belongs to another family, and is a true bean. It has a twining stem, which climbs over bushes in thickets. The leaves are divided into from three to seven narrow oval leaflets, and the violet-scented purplish or chocolate-colored flowers, in close clusters, are shaped like a pea blossom. On its underground stems are many edible enlargements shaped like a pear, which suggested the name Ground-nut.

A PLANT THAT CATCHES AND EATS INSECTS

One of the most curious of all our plants is the Pitcher Plant, common in peat-bogs and swamps from the Atlantic to the Pacific. The plant bears, close to the ground, a cluster of hollow cup-like leaves which are reddish without and pale green streaked with crimson within. The cups are broadly winged at the side and hooded above. These cups not only attract attention by their peculiar pitcher-like shape and rich markings, but they arouse curiosity because of the trap they set for insects. They are

partly lined with a sweet juice, below which, for a short space, they are highly polished; while below the slippery surface there are stiff hairs pointing downward. The cups are usually partly filled with water. Insects are thus easily entrapped and drowned in the water. Thoreau wrote: "Though the moss is comparatively dry, I cannot walk without upsetting the numerous pitchers which are now full of water and so wetting my feet." The name Huntsman's Cup is often given to the plant.

THE FLOWER OF THIS CURIOUS PLANT

The flower of the pitcher plant appears in early June, and is not less interesting than the leaves. It is red or dull purple, large and nodding, and suggests by its form the name Side Saddle flower. The five sepals are red or purplish, and each has three brackets at the base. The corolla has five fiddle-shaped red petals which are arched over the greenish yellow style. There are numerous stamens, and the pistil has a five-celled ovary with a short style expanding at the top into a five-rayed umbrella, under the angles of which the stigmas are placed. It is thought that the plant absorbs the digested bodies of the insects entrapped, and thus supplements the small supply of nitrogen it receives from the somewhat poor soil in which it grows. It is therefore an example of a "carnivorous" plant.

THE FLOWERS OF BEAUTY AND OF MYSTERY

The Orchids are among the most mysterious of all wild flowers. Many species are found in North America, but many of them are inconspicuous and rare. A certain fascination attends the very name of orchid, which suggests visions of tropical regions where, most beautiful and sometimes dangerous, they grow to perfection. "Deep hidden in the damp recesses of the leafy woods" throughout the whole East the Showy Orchid appears in May. It has a four-angled stem with leaf-like bracts rising from fleshy fibrous roots, two oblong shining leaves from four to six inches long, and purple-pink flowers in a loose spike terminating a scape. The flower is very irregular in shape, due to the fact that the base of the perianth is closely attracted to the ovary, and only the upper portion is free. The sepals are colored and petal-like.

One of the petals differs much from the others in form and position, and is called the "lip." It serves as a sort of platform on which insects alight. In the showy orchid it is white in color and wavy in outline. The other petals and the sepals are pinkish purple, and united to form a hood which overarches a column composed of a single stamen closely united with a style and stigma. The tip turns down in such a way as to give bees and other insects easy access to a store of nectar at the inner end of the lip near the base of the column. The fine pollen grains are inclosed in a filmy covering, which is ruptured by the head of the bee. The sticky disks of pollen cling to the bee and are carried to the stigma of another flower. The whole structure of the flower seems admirably adapted to bring about cross-fertilization of flowers by means of bees. After pollination the flowers quickly wither and the ovary grows into a pod filled with many tiny seeds. All orchids produce thousands of seeds, but notwithstanding the fact that they seem to possess every natural adaptation to bring about perpetuation of the species, orchids are never very abundant.

Blossoming at about the same time, another member of the Orchid Family, *Calypso borealis*, is found in cool bogs and damp woods, burying its bulbs and coral-like roots in damp moss. "Even when her sanctuary is discovered, Calypso does not always reveal herself. The ground and the fallen tree-trunks are thickly padded with moss and embroidered with trailing vines of snowberry and Linnæa; painted trilliums dot with their white stars the shadows lying under the tangled fragrant branches; the silence of the forest, disturbed only by the chirr of a squirrel or the sudden jubilance of the oven-bird, envelops you and seems the proper accompaniment of such an expedition.

"You follow, perhaps, a winding path made by the wild animals among the underbrush, moving slowly, and you easily overlook the dainty blossoms nestling in some soft, damp nook and poised lightly on its stem as if ready to flutter away between your covetous fingers." The plant consists of a single thin ovate or slightly heart-shaped leaf from a solid bulb, and a variegated pink and yellow flower with a sac-shaped inflated lip,

two-parted and bearded with yellow and pink. The flower is so exquisite that its discoverer named it after an immortal.

THE MANY VARIETIES OF THE LADY'S SLIPPERS

The charm of the Lady's Slipper never wanes. There are several species. One of the earliest, the Stemless, or Pink, Lady's Slipper, is found under hemlocks and pines in early June.

Graceful and tall the slender, drooping stem,
With two broad leaves below,
Shapely the flower so lightly poised between,
And warm her rosy glow.

There are two large oval veiny leaves lying close to the moss and sheathing the

The Pink Lady's Slipper.

base of a scape from eight to twelve inches high, bearing at its top a solitary pink flower with a veiny lip and an inflated pouch. In all species of *Cypripedium* (Lady's Slipper) the lip is swollen and sac-like, forming a nectary. The column is unlike that of the other orchids. A single anther, usually present, is sterile, and forms a flap which overhangs the stigma. Two fertile anthers are attached to the under-side of the column. The flower is fertilized by the common bumblebee, which forces its way in through the fissure in front. After eating he takes the easiest way out, toward the base, where he can see two spots of light. As he forces his way out, the pollen on his back is rubbed off by the sticky stigma. As he struggles out of the flower, an anther, which blocks the passage, clasps its load of pollen on his back, and this is carried to another flower, where the whole process is repeated. Thus cross-pollination of flowers is insured and self-pollination is rendered impossible. Six other species of lady's slippers have been observed.

The Yellow Lady's Slipper blossoms a few days later than its pink sister. The leaves are alternate, broadly oval, many-veined and plaited. The stem is two feet high, downy, leafy to the top and one- to three-flowered. The flower is large, with a pale yellow lip forming an inflated pouch, and two long narrow wavy brownish lateral petals which give the flower an alert, startled look when surprised in its lonely hiding-places. The Showy Lady's Slipper is usually regarded as the most beautiful of all. The flowers are large and white, with the much-inflated lip, about two inches long, pink in front. The stem is leafy, from one to two feet high, and bears at its summit the solitary blossom. It is found in rich woods during June and July.

Two yellow lady's slippers blossom from May to July. The Small Yellow Lady's Slipper grows in swamps from Ontario to the Rocky Mountains. It bears "golden slippers meet for fairies' feet." The flower is fragrant and graceful, and has a deep yellow sac and reddish brown sepals and petals. The Ram's-head Lady's Slipper occurs in cedar and tamarack swamps, but is not common. It bears three or four leaves at the base of a low stem, and a solitary purplish drooping flower, with projecting horns and ears, headed by a tuft of wool.

Here is a message from the wild flowers, translated into our language by Bliss Carman, poet laureate of Canada:

We are the roadside flowers,
  Straying from garden grounds,—
Lovers of idle hours,
  Breakers of ordered bounds.

If only the earth will feed us,
  If only the wind be kind,
We blossom for those who need us,
  The stragglers left behind.

. . . . . .

Who shall inquire of the season,
  Or question the wind where it blows?
We blossom and ask no reason.
  The Lord of the Garden knows.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 6567.

An artist's impression of London in Roman days.

HOW DID LONDON BEGIN?

CONTINUED FROM 6181

THE full story of the making of London can never be told. Its beginnings lie deeper than the fabric of the city. The London of to-day stands fully fifteen feet higher than the London Cæsar knew. Waste and decay throw down matter, but do not destroy it. Rubbish collects and mounts, and buries a city beneath a city. Many successive Londons lie beneath the tide of modern traffic.

The makers of a city's unwritten history die, and with their voices records perish. As the old Londoners did not write, their narratives vanished with them. Yet in the stuff of the ruin we find here and there a guide to the city's history. River-mud and buried fragments yield from time to time a gleaming fragment into which modern learning is able to fit a tongue which sounds like a trumpet-call, a thrilling message from the dead past.

There was a London long before the Romans, and her sons were artists of high attainment. Two centuries before Cæsar crossed the English Channel there were men in England working in metals with a skill and genius never excelled on the continent of Europe. England had her copper coinage a century before Christianity dawned, and from the Thames has been rescued a shield from the Bronze Age as chastely wrought as anything produced by these wonderful craftsmen of olden times before the dawn of learning in Europe.

Relics of those early days show us that London and the surrounding counties stood high in the cultivation of beauty before the Roman invasion of Britain. They show also that beauty-loving Britons were in regular communication with Southern Europe before Rome was a great power.

There is proof that the Britons of old London were travelers, men whose lives were sufficiently safe, peaceful and leisured to allow of journeys, of indulgence in fine art, and of that luxurious labor in which the artistic soul finds its delight. An age which produced intrepid travelers, fearless warriors, and highly skilled craftsmen must have furnished more than wattle huts and rude stockades for so great a city as the London which received the Roman legions. Yet men know practically nothing of it to-day. The name itself is Celtic, like the wonderfully worked metal the city entombs; and the name tells us that the site was fortified. We know that London was a rich city with a large population when Boadicea sacked and burned it nearly nineteen centuries ago. We know that the first Roman wall built

to defend the city inclosed 380 acres, and that under the Romans London became the most important trading and financial centre of Britain.

If we credit the old Celtic Britons with ability to raise a London of some dignity, what must have been the nobility and splendor of London as the capital of Roman Britain during the four centuries of wonderful Latin rule there? Even of that stately period we have no record.

The Romans returned to Rome—probably in the year 418—to prop a falling empire, and London was submerged by waves of barbarism. The great city disappears for two centuries, like a sun eclipsed. From time to time it appears like island peaks above a flooded country, from out the waste of savagery, but not until the time of Alfred does the historian set his feet on sure continuous ground. Then London rises from the thirty years of ashes to which the Vikings had reduced it, and from that time to our own it has never lain at the feet of a conqueror—for William the Conqueror did not take London: London took him. He was accepted by a vote of the citizens, on his promising to observe conditions which they laid down; and those conditions have never been modified.

The United States, Canada and Australia are peopled on the terms that London demanded from the Conqueror. When Americans, Canadians or Australians build a new city to-day, they know that every man in it will have the rights of a freeman, that every man will have the right to inherit his father's estate, and that the state will suffer no class to do them wrong. Those are the main clauses they unconsciously inherit as part of their birthright, because old London got them into the charter it demanded from William the Conqueror nine centuries ago.

ARE THERE FLOWERING PLANTS IN THE ANTARCTIC?

While the Antarctic does not possess the abounding plant life of the Arctic, where at least four hundred species of flowering plants flourish, in addition to hundreds of lower forms, there are in the Antarctic many lowly mosses and seaweeds, and also two flowering plants. One of these flowers is related to the wild campion, and the other is a grass which was first discovered in the South Shetlands over a century ago. It has been found also on the west of Graham Land, which faces Tierra del Fuego, and on one or two islands close by that projecting point of the Antarctic continent. The campion-like plant has been found growing with the grass.

Owing to the extremely short Antarctic summer and the low temperatures there, these plants are unable to mature their fruits, and so they do not reproduce their kind by seeds, but by vegetative processes; that is, by the development of cells which are actually a part of the general plant. In the Antarctic there are only four or five weeks in which plants can get the benefit of sunlight, and the ground is practically always frozen, so that there is not time for a flowering plant to complete its full cycle of life. Yet there are in the Antarctic fifty kinds of mosses and over a hundred lichens. These, like the two flowering plants, mostly reproduce by vegetative processes. There are also about half a dozen liverworts and about seventy species of seaweed. We know altogether about two hundred plants that contrive to live in Antarctica.

WHAT MAKES A WHIRLPOOL?

We make a little whirlpool when we stir our tea, and a whirlwind moving above water will set it whirling for a time. But in many parts of the world there are great whirlpools which remain from day to day or from century to century. The cause of them is the meeting of two currents of water, especially rapid and strong currents. When we take a top or a ball and hold it between our hands and spin it by pushing one hand from us and pulling the other hand toward us, we really see how two opposing currents may affect the water where they meet.

There is a great whirlpool below the Falls of Niagara; another, about which wonderful stories have been told, is the famous Maelstrom off the coast of Norway; but the most famous of all is the whirlpool called Charybdis, in the Strait of Messina. We know that this whirlpool existed thousands of years ago, but the region is terribly liable to earthquakes, as everyone now knows, and it is said that the position of Charybdis has been altered in consequence. Not far from where Charybdis used to be was a great rock, dangerous to sailors; its name was Scylla. It was very difficult for small ships to pass between the whirlpool and

the rock without being engulfed in the one or wrecked upon the other, and to this day when a man has to steer his course of life very carefully between two dangers we say that he is "between Scylla and Charybdis."

WHY DOES COAL BURN, AND NOT A STONE?

The simple answer to this is that a stone is burned already and cannot be burned twice. What happens when a thing burns is that it combines with the oxygen of the air. When it has taken up all the oxygen it can, and has combined with it, it is completely burned and can burn no more. We watch a candle burning and are deceived because we do not see the result of the burning. The result in the case of the candle is a number of gases which we do not notice, real though they be. When various other things are burned the result is not a gas at all, but sometimes a liquid and sometimes a solid. When the gas hydrogen is burned, or combined with oxygen it forms water, which is usually liquid. When the element silicon is burned it makes a solid, and most rocks and sand are made of this. An ordinary stone or sand is really silicon which is already burned, and so can be burned no more. But coal is made mainly of carbon which is not yet burned, and so it can be burned. Burned carbon—that is to say, carbon combined with oxygen—makes the gas called carbon dioxid, which cannot be burned any more than a stone can, and for the same reason: both are burned already.

WHY DOES A FACE IN A MIRROR SEEM CROOKED?

We think that the two sides of our faces are just like each other, but every clever photographer knows that they are not. Ordinarily we notice nothing, but when we see anyone's face reflected in a mirror, then we see the left side of his face as if it were the right, and the right as if it were the left; and as our eye is accustomed to the other thing, his face looks crooked. If you had never seen the person before, you would notice nothing. You have never seen your own face except in a mirror, and if now it were possible for you to see your face as everyone else sees it, your face would look as crooked to you as the faces of your friends look when they are seen in a mirror. Of course, if the two sides of the face were exactly alike, the face would look just the same, whether seen in a mirror or directly. Very rarely in nature does perfect symmetry occur.

WHAT CAUSES A FOG?

There is a kind of fog which is only a dense mist, and it is really the same as a cloud, only near the earth. Fogs are, of course, very common at sea, for the obvious reason that they are made of water, and there is plenty of water there to make them of. Such fogs are perfectly clean, and they probably do not injure our bodies at all. The real danger about them is that at sea they may prevent ships from seeing one another, and so they may strike each other. But the kind of fog we have in cities is a very different thing; it is made mostly of smoke. In certain states of the air, especially when the air is warm enough, smoke rises high into the sky and is blown away; but often when the air is cold the smoke gathers and settles in the form of a fog.

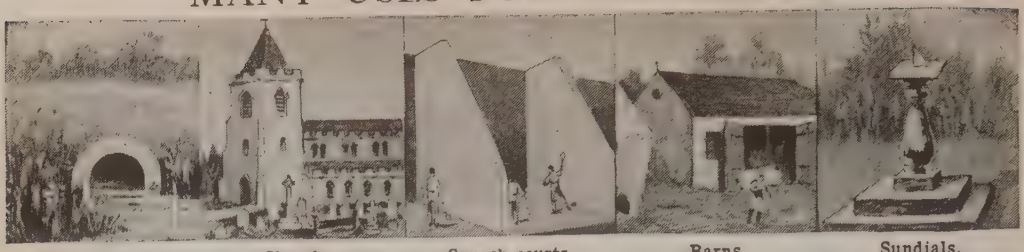
WHY IS CONCRETE USED FOR BUILDING PURPOSES?

Concrete is made by mixing Portland cement, sand, pebbles or broken stone, and water in certain definite proportions. These proportions differ according to the kind of work for which the concrete is to be used. As soon as concrete has been mixed, if left undisturbed, it begins to harden, and soon becomes like stone. The hardening, which is a chemical change, continues for a long time. Concrete grows stronger with age. This increase in strength is the quality in which concrete differs from all other materials. Concrete is low in cost, sanitary, proof against rats, fireproof and water-tight. On the following pages are pictures of some of the hundreds of uses for concrete.

WHAT IS THE FRENCH FOREIGN LEGION?

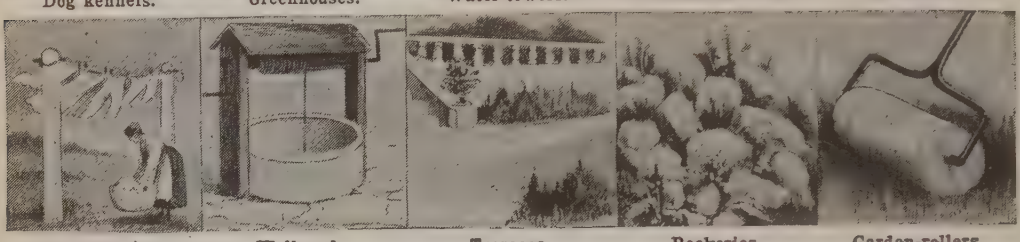
Certain regiments of the French army, recruited from foreigners, chiefly officered by Frenchmen, and with headquarters in Algiers, are commonly known as the Foreign Legion. In peace time these troops supply garrisons for the French colonies, especially Algeria. The age and character of the recruits are not subject to a very strict inquiry, and some of the battalions are disciplinary units of conscripts. The Legion, which has a great reputation as a fighting force, has under-

MANY USES FOR CONCRETE

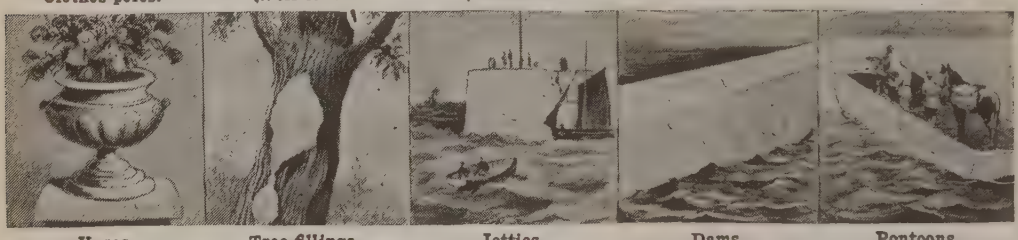


Culverts. Churches. Squash courts. Barns. Sundials.

Dog kennels. Greenhouses. Water-towers. Chicken-houses. Cisterns.

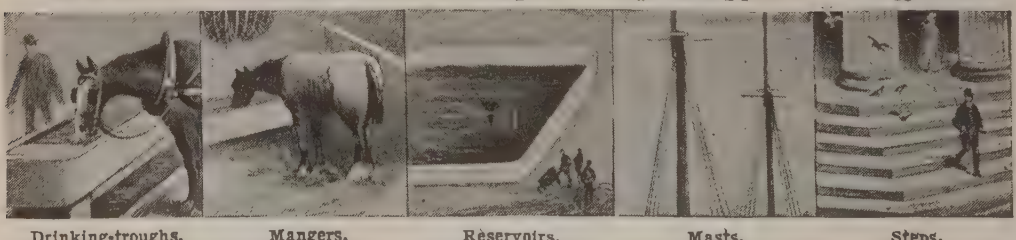


Clothes-poles. Well-curbs. Terraces. Rockeries. Garden-rollers.



Vases. Tree-fillings. Jetties. Dams. Pontoons.

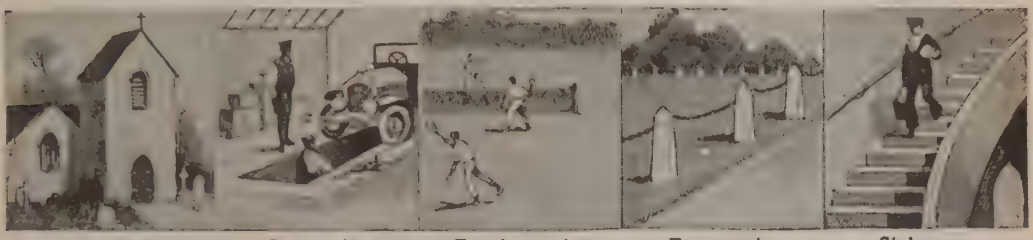
Monuments. Balustrades. Bridges. Swimming-pools. Piggeries.



Drinking-troughs. Mangers. Reservoirs. Masts. Steps.

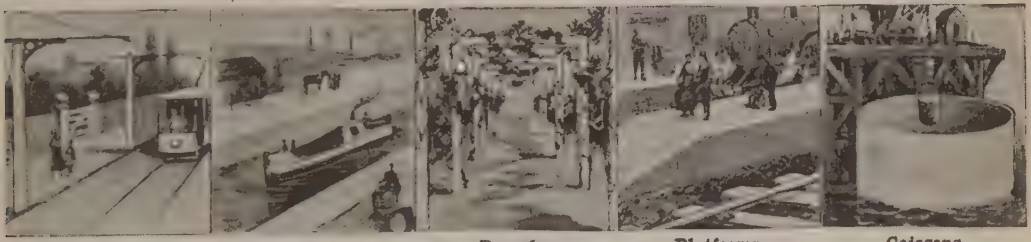
MORE USES FOR CONCRETE

Piers. Walls. Paths. Houses. Pipes.



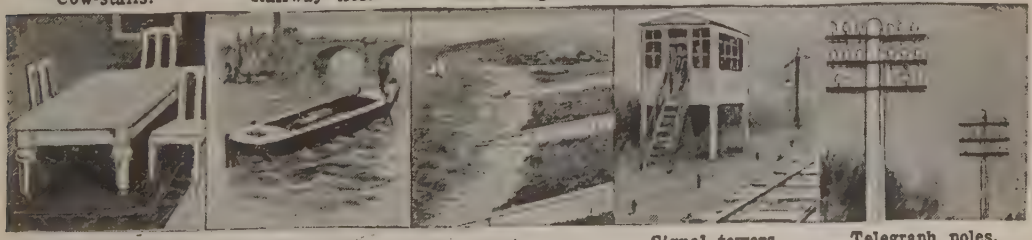
Belfries. Motor pits. Tennis courts. Fence-posts. Staircases.

Roofs. Pavements. Harbors. Blackboards. Lighthouses.



Trolley poles. Canals. Pergolas. Platforms. Caissons.

Cow-stalls. Railway ties. Rifle ranges. Gas tanks. Sea-walls.



Furniture. Barges. Groins. Signal towers. Telegraph poles.

gone a number of changes since the World War, its scope being considerably widened. Before 1919 it was composed of Alsatians and Lorrainers born under German rule, as well as of men of other nationalities who had French sympathies or desired a life of adventure.

WHAT ARE THE LOW COUNTRIES?

The name Low Countries was formerly applied to the Netherlands, or Holland (Hollow Land), of which Belgium once formed a part. It indicates the low-lying nature of the land, which is chiefly a delta formed by the alluvium from the great rivers Rhine, Meuse, Waal and Scheldt, which flow through it into the North Sea. Before England was separated from the Continent nearly all Holland and part of the east of England were under water, making a great bay of the North Sea. As the sea gradually retreated northward the Rhine flowed as far as Cromer to meet it. The hand of man has pushed the sea yet farther north, till now a quarter of the whole of Holland is below what was high-tide level at Amsterdam before the sea was banked up; and another eighth is less than forty inches higher. The sea has been pushed back by the building of dikes. Dikes, too, inclose the rivers and lakes, and marshy lands are gradually being reclaimed by their use and turned into fertile fields.

WHAT IS THE NOBEL PRIZE?

Five prizes, worth several thousand dollars each, are awarded annually, under the will of Alfred Nobel, a Swedish chemist, inventor of dynamite and other high explosives. He made a fortune from the manufacture of these and out of the Baku oil-fields. He died in 1896. By his will he left a large sum of money to provide prizes each year for the person who has done most to promote peace, for the most remarkable piece of idealist writing, and for eminence in physical, chemical and medical science respectively.

WHO WAS ST. PATRICK?

St. Patrick was the British apostle who converted Ireland to Christianity. There were Christians in Ireland before his time, but they were accounted heretics, and St. Patrick was sent to spread the true faith. He is said to have founded over 360 churches and to have baptized more than 12,000 people. Some hold that he was born in Glamorganshire, and some at Kilpatrick on the Clyde. The date was about A.D. 390, when Britain was still in Roman occupation. While yet a boy he was carried off to Ireland by raiders, but escaped after six years' bondage. Later, as the result of a dream, he formed the ambition to return and preach Christianity to the Irish. It was not till he was over forty that he was made a bishop and allowed to return thither, having spent most of the interval in study and meditation in Gaul.

WHO WERE CASTOR AND POLLUX?

In Greek mythology Castor was famed as a tamer of horses and Pollux as a great boxer. They reigned as joint kings in Sparta and had many heroic adventures. One legend makes Castor mortal and Pollux immortal. When Castor was killed and went to Hades and Pollux wanted to join him there, Zeus permitted him to spend alternate days in Olympus and in Hades. Their brotherly love was rewarded by their being made stars, and they figure still as the Heavenly Twins in the constellation of Gemini.

WHERE IS THERE A MONUMENT TO THE SEA-GULL?

At Salt Lake City there is a monument to the sea-gull in memory of a fine service it once did to the state of Utah. The state was once invaded by a vast army of grasshoppers, which devoured every green thing in its path, so that the farmers despaired of saving anything from their crops. Disaster seemed at hand, but at the most critical time an immense flock of sea-gulls flew in from the Pacific. Settling on the area threatened with destruction, they set to work to eat up the myriads of winged pests. They did their work so well that the plague of grasshoppers was stopped, and ruin was averted.

The Sea-gull Monument.

DOES AN OSTRICH HIDE ITS HEAD IN THE SAND?

No; an ostrich does not bury its head in the sand. But ostriches, when in flight, will sometimes sink to the ground in a heap. When they do so they are scarcely distinguishable at a moderate distance from the small ant-hills with which the African plains, where they flourish, are covered. The trick has been taught to them by a million years of experience in concealing themselves from enemies or disturbers of their peace. Early travelers in Africa gave birth to the legend that the ostrich was convinced that it could not be seen because things were hidden from its own eyes.

WHY DOES HEAT CRACK WOOD?

There is a good deal of water in wood. Now, water occupies space, and, like other liquids, will not be squeezed. When wood is heated and the water is driven off, it means that the whole balance of forces holding the wood together must be interfered with. Another reason why wood cracks when heated may be that the heat melts and destroys certain substances which hold the fibres together.

WHAT HAPPENS WHEN OUR FOOT GOES TO SLEEP?

This question concerns one of the most mysterious, most beautiful and most wonderful things in the human body—the nervous system.

Our muscles, as we call the bands of flesh which move the different parts of our bodies, can move only when directed to do so by our motor nerves, which may be roughly described as telegraph wires between our nerve centres and our muscles. Before the mysterious order is sent from the nerve centre along the motor nerve to the muscle directing it to move, the nerve centre has to receive a message from another and quite different nerve called the sensory nerve. Scientific men call this *reflex action.*

From the brain, or from the spinal cord (the big nerve which runs up the backbone) motor and sensory nerves are connected to every part of the body. If a motor nerve is cut, we lose all control of the part of the body it serves, but sensation remains. If a sensory nerve is cut, we lose sensation in the part which it serves, but retain the power of movement. If both are cut, we lose both sensation and the power to move.

Fortunately for us, serious damage to a nerve does not often occur, but not infrequently we experience what undue pressure on a nerve can do. If we sit on a chair so that a sharp edge presses the nerves of our leg, we may easily find that our foot "goes to sleep." What has happened is that pressure has affected the nerves serving the foot, and by compressing their fibres has made them incapable of transmitting impulses. On attempting to rise we cannot feel our foot because the sensory nerve has been pressed, and we cannot direct the foot to act because the motor nerve has been pressed. The foot is numb. Gradually the nerves recover as the pressure is removed, and we get the tingling we call "pins and needles."

WHAT IS DAYLIGHT-SAVING?

In all civilized countries for years past people have been gradually keeping later and later hours, with the result that for half the year at least they have missed much of the daylight. In the bright hours of the morning they have been in bed asleep, and for hours after darkness has fallen in the evening, they have been going about their business or pleasure in artificial light.

It was impossible to get the nations to change their social habits and rise and go to bed earlier. An Englishman, Mr. William Willett, thought of the brilliant idea of changing the clocks during the summer months and making people all get up an hour earlier. Another hour of daylight was gained, while at the same time people were able to imagine they were rising at the usual time.

The question was much discussed in the British Parliament, but it is doubtful if the plan would have been adopted had not the World War made it imperative to save artificial light. In the spring of 1916 the British Parliament adopted the scheme, and it has been repeated each year since. On a certain day, by Act of Parliament, all the clocks are overnight put forward one hour, so that people get up the next morning at what appears to be the same time, but is really an hour earlier. In England this artificial time, which gives an extra hour of daylight during the waking hours at the end of the day, remains in force about six months. Then, on a given night, all the clocks are restored to Greenwich time by having their hands put back one hour.

Germany followed England's lead in 1916 and adopted daylight-saving as an emergency war measure. Other European countries adopted the plan. The United States, Canada and Australia tried out the scheme. Of these the Australian Senate repealed its Daylight-Saving Act in 1917. The United States did the same in 1919. After 1921 in Canada the use of daylight-saving time became optional. In Canada and the United States the railways run on standard time and most country places keep to the regular time. The larger towns and cities adopt daylight-saving time.

COULD PEOPLE LIVE WITHOUT RAIN?

If there were no rain there would be life only in the sea. In parts of the world where there is no rain there is no life. Rain is treasured and prayed for in countries where there is not enough of it, or where it falls only at certain seasons of the year. We must think of rain as something that cleans and washes the air, nourishes the vegetable life on which our own life depends, and insures a supply of fresh water all the year in every part of the world where sufficient rain falls.

WHY DO BIRDS CAST THEIR FEATHERS EVERY YEAR?

Feathers become worn, torn and broken, and must be replaced. We do not know how birds manage to molt their feathers; it is one of the wonderful provisions of Nature, whose effects we see without being able to say exactly how they are caused. But the molting of birds is similar to what takes place in other forms of animal life. Horses grow long coats of hair in winter which they shed in summer. Dogs cast their coats. Snakes cast their skins; crabs and other shellfish cast their shells. If a crab lived always in one shell its body could never grow any bigger. At a certain time in the year its flesh becomes very watery, so that it can draw its great claws through the narrow opening at the top of the shells in which they are inclosed, and it comes out of its shell almost as soft and pulpy as an egg in its skin with its shell removed. Birds are never left bare like this. They molt gradually. Yet some are so completely robbed of their strong feathers that they are glad to go into hiding until the new ones grow. Featherless they are as defenseless as the stag which has shed its mighty antlers.

WHY DO MUSICAL SOUNDS COME FROM THE ORGAN?

When the organist puts his finger on a key he allows air to enter the pipe that corresponds to the key he touches. The air is thrown into vibration in the pipe, and this spreads in all directions through the air and makes the sound we hear. It is really a vibrating column of air that produces the sound, while in the piano it is a vibrating string transferring its vibrations to the air around it. So the organ is really a huge wind instrument, as the other is a stringed instrument. The rate at which the column of air vibrates decides the note we hear, and depends on the length of the column, which, of course, depends on the length of the pipe. Thus, a pipe thirty-two feet long will hold a column of air that vibrates just half as fast as the column in a pipe sixteen feet long, and the note of the longer pipe will be exactly an octave below the other. If there were nothing but a plain pipe, the air would simply rush through it with a hiss. At one end of the pipe there must be something to throw it into vibration, a "tongue," or "reed," which may be made of various materials and shapes according to the quality of the note we want. But the pitch of the note is decided by the length of the pipe.

WHAT IS A PYRRHIC VICTORY?

Pyrrhus, king of Epirus, when helping the Greeks against the Romans in Italy in 280 B.C., won two battles with such severe losses in killed and wounded that he had to retreat into Sicily. Thus a victory won at a cost so great as to make it worthless is called a Pyrrhic victory.

WHY IS GRANDMOTHER'S HAIR GRAY?

The color of the hair depends on the quantity of coloring matter it contains. Hair containing a great deal of coloring matter, or pigment, as it is called, is dark; hair containing very little is light. The production of this coloring material depends on the whole body being in a good state of health, and it is controlled to a very large extent by the nervous system. If anything happens to go wrong with this control, either as the result of disease or the wearing-out of nerve power in old age, the pigment gradually ceases to be produced, and the hair becomes gray, and then quite white.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6549.

Photo, courtesy of Mrs. Whitney.
Memorial to the first contingent of the A. E. F. at St. Nazaire, by Mrs. Harry Payne Whitney.

HEROES OF AVIATION

CONTINUED FROM 6140

IN the recent World War among the heroes who gave their lives for their countries, perhaps the most striking examples are to be found in the aviation service. These men incurred the greatest of risks every minute they were in the air. On the slightest hesitation or indecision they might be dashed to the ground, in the enemy's lines perhaps, to perish in the flames of the wrecked machine or remain a prisoner—a sad fate, and an almost certain one. Yet they gave their lives willingly and cheerfully, and, one might almost say, thoughtlessly, in the sense that they never seemed to think of the danger at all, although many victories might go unwitnessed. In order for an aviator to earn the title of ace it was necessary for him to bring down at least five enemy planes which were officially recognized.

Perhaps the most beloved of all the aces was the daring Georges Guynemer, the idol of France. This slender, delicate boy of twenty-two, who all his life had been guarded from trouble and worry, was a most valiant spirit. He burned with the desire to bring down his enemy, and no danger was too great, no distance too far, no opponent too strong or too well equipped to deter him from his purpose. He took such great risks that he was brought down seven times and still escaped death. His plane was often riddled with bullets, and he himself was shot, once through the hand, but he never faltered. His official record showed fifty-three planes brought down, but all his comrades knew of many more victories.

Among the many adventures of Guynemer's flying career, perhaps the most amazing is that of January 26, 1917. He sighted from camp an enemy plane at an altitude of 12,000 feet, and straightway went up after it. His own machine had been destroyed a few days before and he was using a plane which belonged to one of his comrades. Guynemer always kept his own plane in the finest condition, going over it before every flight, trying the screws, the gun and all the parts. When he got near enough to the enemy he fired ten shots at him in rapid succession, and then discovered

that the gun of his borrowed plane was jammed and would not work. At first dismayed, on second thought he decided to try a bluff. He rose 2,000 feet above the other plane and dropped down on it suddenly. His opponent at once began to descend, and Guynemer literally chased him until, to his surprise, the gunner made a motion of surrender, and the two planes prepared to make a landing. On reaching the ground Guynemer discovered that some of his first shots had hit the altimeter and revolution counter of the enemy plane, which prevented its pilot from guiding the machine. The German pilot did not know, of course, that Guynemer's gun was disabled.

But all this reckless adventure reacted on the young Frenchman's nerves and he became ill. His comrades begged him to refrain from flying for a time, but he disregarded the advice, and on September 11 he flew away and never returned. When the official report from Germany was finally received it stated that Guynemer's plane had been disabled and Guynemer shot, and both destroyed by a British fire directed against the spot where they lay. As this was an absolute contradiction of a former report, the last and greatest adventure of the marvelous Georges Guynemer will always remain a mystery.

So much that seemed to be miraculous was connected with this bird-man, that some of the French people were sure that he had simply tired of the earth and had flown through the sky straight to the shining gates of heaven.

René Fonck, the French ace of aces, was the most famous air duelist in the world. He brought down fifty-nine enemy planes that were officially recorded. Unlike Guynemer, he was very calm and careful in the pursuit of his duty, and never flew when not in perfect physical condition. He was never wounded, nor was his machine riddled with shot, as were so many of the other planes. He had a trick of self-defense which amounted to an art, and although he had usually to fight against from three to five opponents, because they flew in group formation, none of them was able to break through Fonck's guard.

On one occasion Fonck flew over the German lines to his usual position and brought down six planes in less than two hours. He brought down three of the planes in five minutes, and then went back to the aerodrome for an hour. At the end of that time he flew back and brought down one more. He then saw a group of four fighters convoying a squadron of five Albatros. He brought down one of these, and then when the whole group attacked him he flew under them and shot down the last one. Six in a day was enough for him. So home he flew. Fonck received so many citations that the Government could not keep up with his record. One of these read: "Incomparable Pilot."

The first great English ace was but nineteen years of age when he received his pilot's certificate and started to fly. This was Albert Ball, of Nottingham, who was killed less than two years later, with an official record of forty-three enemy planes shot down. He was called the "English Guynemer," for he had the same youthful enthusiasm and reckless audacity of the French ace. He received the Military Cross, Victoria Cross, and Distinguished Service Cross, not to speak of many orders bestowed by the other Allied countries.

Fighting was great sport to this lad, and on one occasion he and a German adversary, having exhausted their ammunition without having wounded each other, drew up alongside and shook hands before departing.

Made an instructor in a flying school, Ball was restless and unhappy, and after many pleas he was allowed to go back to active service. In the encounter in which he met his death Ball and a companion brought down one enemy plane and then attacked four others. Ball's companion, however, after bringing down one of them, was shot in the wrist and had to return to camp, where he fainted from pain. Ball was left alone against three, and although he had often fought greater odds, he was shot down by the great German ace, Von Richthofen, on May 7, 1917.

The greatest of all the British aces, and the only man living with such a high record, is Colonel William A. Bishop, of Canada, with seventy-two victories credited to his account. In his first fight he shot down his enemy and, rather in a daze, began to get his bearings, only to discover that his engine would not work. He was in enemy territory, and his heart sank with the thought that his first vic-

tory would be his last. He guided the machine to the ground and jumped out to hide behind some bushes. When the soldiers came to capture him he heard them talking in English. He had landed a hundred yards behind the English lines without knowing it!

During the battle of Arras, Bishop was flying above the trenches and saw the British line unable to advance and many soldiers being killed by a hidden machine gun. He started out to find its position. When he found it he flew but thirty feet above it and poured every shot he could at it and its defenders, and later had the satisfaction of seeing the British advance without further interference.

Another time he flew over the German lines early in the morning, and by firing down at them tempted someone to come up and fight with him. One after another, he sent three planes crashing down, and then, feeling hungry, as he had had no breakfast, flew calmly past the other planes which had come up to fight, and went home. This feat was never credited to Bishop because it was unwitnessed and belongs to that great number of victories which only the enemy and Bishop could vouch for. He had a most brilliant career, and after seventy-two victories the British Government retired him from active service.

A great many British aces distinguished themselves. One of these was Captain James McCudden, V.C., who destroyed fifty-four planes, of which forty-two were officially recorded.

The first Belgian ace was Lieutenant Thieffry, who began as a bomber and was very successful in night raids. This dangerous work, exciting as it was, grew monotonous to his restless spirit, however, and he asked to be transferred to fighting aviation. Thieffry spent every available minute in the air, scarcely taking time to eat or rest or put his machine in order. His thirst for adventure was unquenchable. One day, returning from Bruges, Lieutenant Thieffry saw fourteen Albatros arrayed against him. Without a moment's hesitation he darted through the formation, shooting down two of the planes on his way. Astonished into indecision, the twelve enemy planes accompanied the Belgian ace the rest of the way to camp as a sort of guard of honor, but did not attempt to harm him. He was later captured by the Germans.

Foremost among the Italian aces was Major Baracca, killed in June, 1918, after having made over a thousand flights into the enemy's territory, bringing down thirty-six planes. On the day of his death he had been over the line five times, but the last time the odds were too great and he fell within the Austrian territory. Later, when the Italian troops advanced into Austria, they found Baracca's body with a bullet through the head. He had fought so steadily and well in guarding the air along the Italian front that he ranks among the greatest of the air fighters.

The greatest German ace, the brilliant young Baron von Richthofen, courted danger as a knight his lady. He painted his machine scarlet so that all his enemies could identify him without any trouble. He was fearless and audacious to the last degree. The planes in his squadron were all brightly colored, each pilot following his choice, and the British called them "Von Richthofen's Circus." The Germans counted captive balloons in their records, and this brought Von Richthofen's score up to eighty just before the fatal day in April, 1918, when he met his death at the Amiens front.

On that occasion he was flying with twenty companions toward the British lines when he spied two British planes, and leaving his comrades, began to chase them. He attacked one, and the other got above him. Their guns roaring, the three planes raced to the British lines, flying gradually nearer the ground, until finally they were only a few hundred feet above the British trenches. Other British planes had engaged the companions whom Von Richthofen had left behind, so he could get no help. Fire began to pour from the trenches beneath, and the two British planes were firing also. Suddenly the German plane crashed to the ground: Von Richthofen had a bullet through his heart. He was buried with military honors, British and American airmen in attendance as a tribute to a brilliant and brave young pilot.

The foremost American ace was Raoul Lufbery, who served under the French flag from the beginning of the war. This young man had left his home in Connecticut when a mere boy to "see the world." He roamed all over Europe and part of Asia, and was in Cochin China in 1910, when by chance he met Marc Pourpre,

the French trick flyer, who was giving exhibitions. The aviator had lost his mechanic, and Lufbery succeeded in persuading Pourpre to give him the position, although he had had no previous experience of the kind. He stayed on as a mechanic even after the war broke out, when he and Pourpre both joined the French service. Pourpre was killed, and Lufbery applied as a pilot and was accepted.

After some months he was transferred to the Escadrille Lafayette, of which there were to be so many famous members. Lufbery had been in the United States army and had served in the Philippine Islands, where he had become an expert marksman. In his travels around the world he had observed so many things and remembered them so well that it was said of him: "He is not a man, he is an encyclopedia." He was always practical and careful, but absolutely without fear.

One day he was flying above the Vosges, gazing enraptured at the beauty of the country below and trying to get the reflection of his machine in a little silver lake. In his manœuvring he thought he detected something wrong with his motor and decided to get to more level land. Flying along, he sighted a Fokker biplane and began to attack it. He was unsuccessful, however, and wearying of the fight, when he saw an enemy plane within the French lines. Waving farewell to his first opponent, he started for the other. He was very anxious to bring it down within the lines, so he advanced until he was so near that the two planes nearly collided. In the midst of the attack he discovered that his motor was wrecked. The enemy plane did not open fire, but flew away. Lufbery landed and found his plane ruined. A close call!

When America entered the war Lufbery and Major Thaw, another American wearing the French uniform, were given charge of the American escadrilles that were formed. Lufbery continued to fly, as well as instruct, and one day, when rushing to attack the enemy in the American lines, a bullet set his petrol tank on fire, his machine went up in flames, and his jump from the burning plane cost him his life.

The first American-trained ace was Lieutenant Douglas Campbell, of California, son of the head of the Lick Observatory in California. This young man won his right to the title of ace by bringing down five planes in a little over a month.

Besides the famous aviators whom we have mentioned, each nation had many others. All of them lived, and most of them died, for the same glorious ideal—their country and her welfare—and posterity will honor their memories.

THE MAN WHO THOUGHT OF HIS COMRADES

DURING the construction of the railway between Manchester and Leeds, in England, a number of tunnels had to be bored. Shafts, some of them two hundred feet deep, were sunk from the hill-tops to the tunnels for purposes of ventilation.

Among the men employed on this work was a laborer whose duty was at the top of the shafts. He had to raise the tubs filled underground and return them empty to the other workmen. If any mishap occurred, such as the breaking of a chain or the falling of a piece of loose rock, he had to warn the men below, so that they could get out of the way.

One morning while he was thus engaged at one of the deepest shafts on the line his foot slipped, and he felt himself falling toward the narrow channel against whose ragged sides or on whose rocky bottom he knew he must be hurled and killed.

In that terrible moment, however, he did not lose his presence of mind. His first thought was of his comrades. If he cried out for help, the men below would rush out of their shelters to see what was the matter, and even if they succeeded in saving him it would be at the tremendous risk of losing their own lives.

So the man, with a chivalry as great as that of any knight, gave in his usual voice the signal, "Look out below!" Secure in their places of safety, and ignorant of what was happening, the workmen below heard the crash as their comrade fell. In his death, by suppressing the instinct to cry for help, he became the savior of his fellow-workmen.

HOW LADY GODIVA HELPED HER PEOPLE

WHEN Leofric the Dane was Lord of Coventry, in the year 1040, he heavily increased his taxes on the townsfolk. The people met together and sent their chief men to implore his wife, the Lady Godiva, who was greatly beloved by them for her many gracious acts to the sick and the poor, to plead with her lord to remit some of the heavy taxes.

LADY GODIVA PLEADING WITH HER HUSBAND FOR THE PEOPLE OF COVENTRY
This picture is from the painting by E. Blair Leighton, which now hangs in the City Art Gallery, Leeds, England.

Accordingly Lady Godiva pleaded with her lord on their behalf, but he roughly refused, saying, "Shameless are you to plead for these base, whining serfs."

"Shameless am I? Then shameless will I be indeed, and we shall see whether these serfs be base or honorable," replied she with spirit. "For I will ride through this town, clad in nought but my long tresses, if I can thus turn you from your cruel purpose."

"Ride thus, and I yield," he replied. Lady Godiva sent out word to the townsfolk of her bargain, and on the following morning she rode from end to end of the town of Coventry, and every inhabitant remained within doors as she rode, to spare their beloved benefactor any possible feeling of shame. Leofric kept his word to his wife. The burden of the people was removed, and to this day the citizens of Coventry delight to do honor to the memory of Lady Godiva.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 6393.

The Loggia of San Paolo in Florence.

The Church of San Spirito in Florence.

The Campanile of San Spirito.

Inside the Church of the Certosa of Pavia.

On the Grand Canal in Venice.

Balbi Palace in Venice.

Photos, Messrs. Alinari, Anderson, Brogi, McLeish, E. N. A., and others.

The back of the beautiful Pitti Palace in Florence.

THE RENAISSANCE IN ITALY

CONTINUED FROM 6172

WE were last thinking of Gothic architecture, that vast growth which seemed, during the first hundred years of its branching, to be something of a miracle. It was, we remember, a religious architecture, and as such came to its end and died.

There have been revivals in Gothic —one of them produced a number of buildings in England during the last century—but there have never been any side developments of it. Nothing has been evolved out of Gothic suitable for municipal buildings.

The style which followed it rose in a country where the Gothic movement had found little favor—Italy. It bears the general name of Renaissance architecture; but this is quite distinct from the Renaissance in painting and sculpture which happened much earlier.

When Renaissance architecture was developed the Middle Ages were past. The invention of the printing-press had naturally opened up wider learning than in the days when the monks were the sole tutors of Europe.

The spreading of printed books throughout the Continent had two results—the Reformation and the Renaissance in architecture and literature. Books made men think, made men rub their eyes and dimly feel the loveliness of Greek and Roman art and literature. In reaction, they presently turned aside from productions of medieval Europe, and found nothing worthy unless it had the classic spirit. We call this intense interest in the history and literature of the past in the fifteenth and sixteenth centuries Humanism.

Besides these internal happenings there was an outside event of much significance. In 1453 Constantinople, the centre of Greek and Roman art and learning, fell to the Turks, and a great number of Greek scholars, fleeing from the conquerors, settled in Italy. They came at a time when the country was sensitive to their "touch," and the effect on Europe as a whole cannot be estimated.

Thus, after being forgotten for a thousand years or so, after centuries when the buildings of the old Roman Empire containing beautiful Greek statues had merely served as a quarry, classic art again triumphed in Italy, and produced, among other things, Renaissance architecture.

This new style, we must remember, which first appeared in Florence and her neighboring towns, was born of classic ideals, but it was not classic architecture simply copied in another

country. It was an architecture that used classic ideals only in so far as they were suited to the needs of a new race. Therein lay its strength.

It grew slowly, like all great styles. From the outset it was as much suited to secular as to sacred buildings, and it was different from Gothic in that its construction was saner and capable of all kinds of development. It branched out in many directions, and to it most of the buildings of to-day can be traced.

THE DIGNITY AND STRENGTH OF THE BUILDINGS OF FLORENCE

When Florence took the lead in Renaissance architecture she was the queen of cities, and there were many jewels in her crown. She led Europe in the matter of art; her great industry and pride had created immense wealth and power; she was the strongest force in Italy. She was nevertheless at the mercy of the fortunes of war, within and without, and it was natural that her chief buildings should be in the style of fortress-palaces for her reigning princes, like the Medici.

There was plenty of fine stone and marble in Tuscany, and this material, being quarried in large blocks and set rough-hewn in the walls, gave at once a rugged character to the new architecture. The chief note of buildings like the Riccardi Palace and the Pitti Palace in Florence is enormous strength combined with fine dignity.

The architects seemed to begin these great palaces with the idea of a four-square fortress, and made as few openings on the ground floor as possible. One can easily imagine the Riccardi standing a siege. In the higher stories the buildings seemed to breathe a little—set with tall, rounded windows in unbroken regularity. Sun screens catch the light and make patches of shadow on the stonework. Then, surmounting all, a huge cornice ran its unbroken line round the building and seemed to frown down on the narrow street with its gaily dressed passers-by.

THE FINE FINISH A CORNICE GIVES TO A BUILDING

The Riccardi, famous forever because of the Medici, for whom it was built about 1430–34 from the designs of Michelozzo, is the most fortress-like of these early Tuscan palaces. It was known as the palace of the Medici, and took its present name only when, in 1659, the Marquis Riccardi became its owner.

The Strozzi Palace is another of these fine rugged buildings, set up in 1489. Two architects, Da Majano and Cronaca, worked on it. Cronaca also built the Guadagni Palace. The Ruccellai Palace, erected about 1450, marks a slight change. It has no cornice—suffering a little thereby, for that frowning line finishes a building in a very fine way—and on the Ruccellai appear for the first time the classic pilasters which became such a feature in Renaissance architecture.

Among these princely houses the Pitti Palace stands as chief, famous the world over. It was begun by Brunelleschi, the first great architect of the Renaissance, in 1441, and about a hundred years later was finished by Ammanati. The palace was built for Luca Pitti—one of the powerful fifteenth-century Florentines, a great tyrant who used his power as magistrate to force citizens to find money for his palace. When the family fell on evil times the house was sold to beautiful Eleonora, wife of Cosimo I, the Grand Duke, in 1549. Eleonora had the famous Boboli Garden made. Part of its lovely stretch faces the chief court of the Pitti, where the architect set up the classic columns.

THE WORK OF CENTURIES IN THE NOBLE PITTI PALACE

The world owes a great deal to the various men, patrons and architects and artists, who during the course of three hundred years worked to make the Pitti Palace one of the noblest places in the world. The building stands on rising ground, overlooking the city and the Arno, and round it, like a great girdle, is thrown the greenery of the garden. The additions that were made in the eighteenth century, after the Pitti had become the home of the reigning king, happily did not mar its beauty. Except for the Vatican, it is the largest palace in Italy.

The Pitti Palace is one of the buildings that one can call noble—most palaces are either grand or beautiful—and this nobility is due, not to its great size, but to its symmetry and perfect proportions, and the long sweep of its lines. Its weight is horizontal rather than vertical, and this strength is increased by the lines that emphasize the stories, and not lessened by one superfluous vertical line or ornament.

From the Pitti, which contains great

treasures of art, a gallery runs on to the Uffizi, once a palace, and now one of the finest art galleries of the world.

When we think of our own achievements, or the work of the last hundred years, we cannot help feeling that the world is passing through a barren period, architecturally speaking.

THE SPIRIT THAT IS MISSING IN THE WORLD TO-DAY

We have never been visited again by the fine spirit that created the Italian Renaissance. In those days a man made a hobby of something that nowadays would be a separate life-work. It was quite usual for an architect to be also a sculptor and a painter of note. The shining examples of this wealth of genius were, of course, Raphael and Michelangelo. But men who did not become so famous shared this richness and fullness of genius. The architect was naturally an artist of first quality. And, moreover, during this period the servants of architecture, the craftsmen, were persons of great gifts. The woodcarvers, goldsmiths, ironworkers, the kind of sculptors we should call now monumental masons, alone would have made the century memorable. At the end of the Renaissance the wave of golden energy ebbed away. Since then we feel that our best efforts have been only imitation.

Many architects were at work in Florence and the neighboring cities—men like Borgognone, Michelozzo, Filarete, Alberti, Alessi, Cronaca, and Brunelleschi, the most gifted of them all.

THE SPLENDID PALACES TOWERING ABOVE THE NARROW STREETS OF GENOA

The Renaissance helped to make Genoa, already marked by some fine churches of an earlier period, a most individual and distinguished-looking city. As in all the great Italian cities, the princes of commerce built palaces which displayed their beautiful lines high above her narrow streets. One of the most famous, now known as Municipio, was the Doria-Tursi Palace, built at the end of the sixteenth century. Earlier than that, Alessi was at work in Genoa, and to him more than anyone else is due the guiding of the taste of the citizens who were so willing and glad to make their town beautiful. Under Alessi's leadership the authorities reformed their famous street which is now called the Strada Garibaldi, and almost all the palaces that make it so picturesque are this architect's work. Others set up at a later date, like the Balbi and the Durazzo, owe much to Alessi.

One of the earliest town hospitals in Europe, the Ospedale Maggiore, rose in Milan during this period. In northern Italy most of the important works were buildings of a secular nature. Many churches and cathedrals, like those of Florence and Genoa, were altered and added to, and some new ones built. In Florence there was San Spirito and San Lorenzo and the Pazzi Chapel—one of Brunelleschi's most beautiful little buildings; and in Genoa Santa Maria in Carignano, the work of Alessi. The most important church of this group, historically speaking, is Sant' Andrea, Mantua, as it was the first to be built in the style that has been accepted as pure Renaissance.

THE TRIUMPHAL ARCH WHICH LEADS INTO A CHURCH

Sant' Andrea served as a model for many later buildings of a sacred character. The Roman arch was now being used by architects for the chief entrance of a church. A good example is San Francesco, Rimini, whose principal porch was to be a copy of the Arch of Severus. Unfortunately the façade was not finished. In Sant' Andrea, Mantua, the Roman triumphal arch forms a fine entrance.

One of the most interesting buildings of Europe is the Certosa at Pavia, the city where so many scholars found peace in the troubled years of northern Italy. The Certosa was planned in the fourteenth century by the chief lord of Pavia, who had determined to have "a palace wherein to dwell, a garden wherein to disport himself, and a chapel wherein to worship." It was begun in the Gothic years and finished in the Renaissance. A history of architecture and Italian beauty thus exists in this group, from the Gothic cloisters up to the strange-looking Renaissance storied tower set at the crossing in the church, and the marvelous gleaming front. This façade of marble, which has mellowed very beautifully, added to the Gothic church by Borgognone, is one of the triumphs of the early period of the Renaissance. A wealth of art was spent on the carved doors and on the interior decoration. One of the finest of the Certosa monuments is that to Ludovico Sforza and the lovely Beatrice d'Este, by Solari.

Northern Italy during the Renaissance

years was like a great forest where art-lovers could wander happily for years, finding ever new beauties, large and small.

The main growth of the movement reached perfection in Rome and Venice. Here the personalities of two architects dominated the work—first Bramante and then Michelangelo.

THE MASS OF TOWERS AND SPIRES IN A GOTHIC BUILDING

Bramante, who was born at Urbino in 1444, two years before the death of Brunelleschi, saw all the possibilities of the new style, and in his work we can see how he developed it. We can also see now at a glance the difference between a city which loved the Gothic style and one which loved Renaissance.

The sky-line of Gothic buildings was a mass of mounting spires and towers and pinnacles, every line in the masonry carried as high as it would go. The sky-line of Renaissance is a long horizontal bar, either a heavy cornice like that of the Riccardi Palace, for instance, or an open balustrade like that of the Capitol at Rome. The ceilings of Gothic buildings were a mass of intricate vaulting; in Renaissance we find horizontal ceilings, paneled and molded or simply arched. The tower of the Gothic church gave place in the Renaissance to a dome at the crossing. We can see this at once by comparing St. Paul's Cathedral with Westminster Abbey. Renaissance windows were very simple and much smaller than those of Gothic buildings. They were square-headed or round-headed; sometimes round-headed in a square frame—a feature which Bramante treated with great refinement; sometimes square-headed surmounted by a triangular pediment—a feature which has become very common in the so-called classical buildings of modern times.

THE PLACE OF THE PILLAR IN THE WORK OF THE RENAISSANCE

The use of the Orders, either as pillars or pilasters, which, we remember, are the fronts of pillars fastened to the wall as an ornament, became the strongest characteristic of Renaissance work. And the more the columns struck a simple vertical line, the more the courses of the stories and roof struck a powerful horizontal line. On the basis of this severe plainness a great deal of ornament was laid.

Bramante, his pupils and assistants, are responsible for a large number of buildings that rose toward the end of the fifteenth century and in the first half of the sixteenth century. His youthful training as an artist was under Mantegna, as an architect under Alberti. Bramante's early work is at Milan; there he built the churches of San Satiro and Santa Maria delle Grazie. Two very beautiful pieces of sacred architecture by Bramante are at Rome—the cloister, with its two-story arcade, of Santa Maria della Pace, and the tiny circular church, a miracle of taste and proportion, called the Tempietto, in St. Peter, Montorio.

Of Bramante's work on St. Peter's and the Vatican we shall be thinking presently. Apart from that his most famous secular buildings are the Cancelleria Palace and the Giraud Palace, Rome. Bramante's assistant, Sangallo the Younger, planned in 1534 what is probably the greatest house of sixteenth-century Renaissance—the Farnese Palace, Rome. Part of it was erected under Sangallo's supervision; Michelangelo added the third story ten years later. One of the chief beauties of the Farnese is its huge unbroken cornice, like those of the Florentine palaces.

THE WORTHY STUDENTS WHO FOLLOWED A GREAT MASTER

The chief of Bramante's pupils and followers are Peruzzi and the great Raphael, Bramante's nephew. To these men the master handed on his scholarly tastes and his admirable restraint; most of the work they produced is worthy of the Bramante tradition. Peruzzi built, among other things, the Villa Farnesina, which Raphael helped him to adorn with frescoes. Raphael was responsible for certain parts of the Vatican, for the front of San Lorenzo, Miranda, and the Villa Madama, Rome, and the Pandolfini Palace, Florence, which was built after his death and is supposed to be his best architectural design. Raphael was also consulted about St. Peter's by the pope, but we do not find that he took any active part in the construction of the great church.

Giulio Romano, the painter, was one of Raphael's pupils and a builder as well. His finest piece of architecture is the Del Te Palace, Mantua, a wonderful one-story building. When it was set up Giulio had the delight of painting some of the frescoes himself.

In the latter half of the sixteenth century some extremely interesting work

GREAT BUILDINGS OF ITALY

THE BEAUTIFUL CHURCH OF SANTA MARIA DELLA SALUTE ON THE BANKS OF THE GRAND CANAL IN VENICE

STA. MARIA DELLE GRAZIE, MILAN

SPINELLI PALACE, VENICE

STA. MARIA DEI MIRACOLI, VENICE

ONE OF THE SPLENDID PALACES ON THE GRAND CANAL IN VENICE

COURT OF THE MAGGIORE HOSPITAL IN MILAN

THE GIRAUD-TORLONIA PALACE IN ROME

TEMPLE IN THE CHURCH OF ST.-PETER MONTORIO, ROME

CHURCH OF SAN BERNARDINO, PERUGIA

THE FAMOUS MEDICI CHAPEL IN FLORENCE

THE CERTOSA OF PAVIA, AN OLD CARTHUSIAN MONASTERY, NOW A NATIONAL MONUMENT

THE GUADAGNI PALACE IN FLORENCE

THE PALACE OF THE DOGES IN VENICE

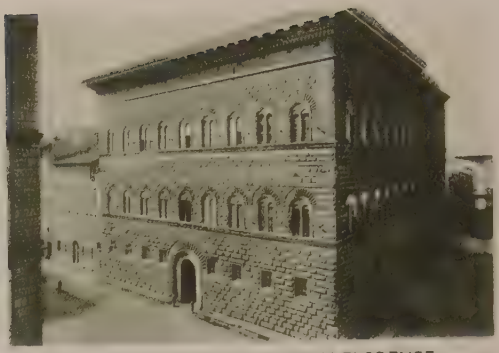
THE RIALTO BRIDGE ACROSS THE GRAND CANAL IN VENICE

THE FARNESE PALACE IN ROME, WHICH MICHELANGELO HELPED TO BUILD

ST. PETER'S IN ROME—THE BIGGEST CHURCH IN THE WORLD

THE VATICAN IN ROME, SEEN FROM THE COLONNADED SQUARE IN FRONT OF ST. PETER'S

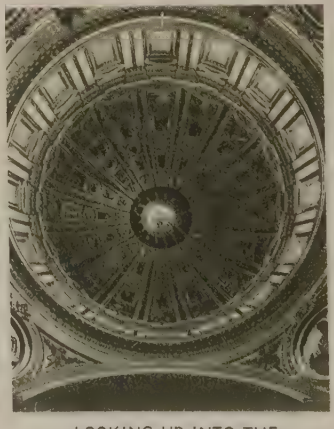
THE VILLA FARNESINA IN ROME



THE GREAT STROZZI PALACE IN FLORENCE

THE OLD TOWN HALL OF VERONA

A DOORWAY OF THE FARNESE PALACE, ROME



LOOKING UP INTO THE CUPOLA OF ST. PETER'S

A DOORWAY OF THE CERTOSA OF PAVIA

THE BASILICA PALLADIANA AT VICENZA

A PALACE ON THE GRAND CANAL IN VENICE

THE PALACE OF THE CONSERVATORI IN ROME

GRIMANI PALACE IN VENICE

A HALL IN THE VATICAN

PISANI PALACE IN VENICE

A GALLERY IN THE RICCARDI PALACE IN FLORENCE

THE BEAUTIFUL INTERIOR OF ST. PETER'S IN ROME

THE ARCHES OF THE PALACE OF THE DOGES AT VENICE

A COURT IN THE RICCARDI PALACE, FLORENCE

A COURT IN THE FARNESE PALACE, ROME

was done by Barozzi da Vignola, who appears to have divided his time between Italy and France, and also found leisure to write a book which was important to students of that century, The Five Orders of Architecture. Among Vignola's chief buildings were the Church of Sant' Andrea and the Gesù Church, Rome, the Farnese Palace, Caprarola, and the Villa of Pope Julius, now the Etruscan Museum, Rome.

THE BIGGEST GROUP OF ARCHITECTURE IN THE WORLD

In the Vatican and St. Peter's all the grandeur of Roman art and history foregathered; with the Piazza they make the largest, most famous group of architecture in the world. The Vatican is called the Palace of the Popes, but the pope lives in only one corner of it.

This huge edifice was not set up in any one period: centuries have gone to its forming. The first bit of the Vatican, adjoining the ancient basilican church of St. Peter, was built at the end of the fifth century. About the year 1200 this fragment was reconstructed; the first additions were made by Pope Nicholas III eighty years later.

During the fourteenth century the popes made their home at Avignon, in southern France. They built a magnificent fortress-palace there, and sent for Italian painters to decorate the walls. In 1377 they returned to Rome, and at once it seemed an interest in art and architecture was aroused in the great city. Presently one of the popes caused a passage to be built on arches connecting the Vatican with the Castle of Sant' Angelo, whither during the terrible sack of Rome in 1527 Pope Clement was glad to flee.

HOW THE VATICAN GREW AND GREW THROUGHOUT THE AGES

Bit by bit the palace was added to, each ruler trying to leave his stamp on it. Pope Sixtus built the Sistine Chapel, of whose decorations we read on page 831; Alexander added the Borgia Tower. In the reign of Leo, and the warlike Julius who swung his sword, so to speak, through so many artists' lives, Bramante added his famous parts—the Court of St. Damaso and the Belvedere Court; and Raphael decorated his gallery and rooms. A later pope caused Sangallo, the architect, to add the Pauline Chapel and other apartments. After that the palace was widened, Bramante's courtyard being added to on the eastward side. Addition after addition came, courtyards and magnificent staircases and galleries, and at last the Vatican with a thousand rooms was finished. It is now a treasure-house of art, containing the largest collection of classic sculpture in the world.

In 1505 Pope Julius was taken with the idea of building a tomb-house for himself; from it grew the largest church in the world, St. Peter's, Rome. In order to clear the way Julius had the old basilican church pulled down (this had been built by Constantine in 330 near the place of St. Peter's martyrdom in Nero's circus) and then he invited all architects of note to compete for the work of the new building. The drawings and sketches made for this monument are now treasured in the Uffizi, Florence, and they show what a wealth of art there was in Italy in those days.

Bramante's design was the one chosen, and in 1506 the foundation-stone was laid. His plan was to build St. Peter's in the form of a Greek cross with a huge dome like that of the Pantheon, and a tower, in stages, of most beautiful work, at each of the four points of the cross.

THE ARCHITECTS WHO TRIED TO UPSET THE PLANS OF BRAMANTE

Seven years later Julius died, and his successor called in Sangallo, Fra Giocondo and Raphael, who naturally did not agree with Bramante, being architects themselves. The work of the first two was finished before they could alter much of the magnificent work Bramante had begun. Raphael suggested that the Greek cross should become a Latin cross, which, considering the proportions and general mass of the building, was a stupid suggestion. After Raphael's death Peruzzi was made the architect, and he liked the Greek cross formation. So, one way or another, the church grew.

Troubles within and without disturbed both the building and its advisers. The work had to stop for want of money; then war cast its shadow across the climbing walls; the sack of Rome, that seven months' horror, came. Peruzzi died in 1536, and Sangallo the Younger became architect to St. Peter's in his place. It seemed that no man could go on with the plan originally accepted; each had to make his mark in some way, and build, or try to build, a St. Peter's of his own. Sangallo proceeded to work according to his plan, but before he could

finally spoil the building death in turn took him. And then on to this stage of many actors strode Michelangelo, genius and master.

The master was seventy-two, but not too old to fire guns. Slip-slap, to right and left, was shot the work of other men. Once more Bramante's plan of the Greek cross was reverted to, the two geniuses meeting on this point of taste. As such the church was carried on, but Michelangelo added his own treatment of chapels and apse. His work was vigorous and sane, and he began constructing the huge dome in the daring manner which has been the amazement of architects ever since.

THE ONE IDEA OF BRAMANTE WHICH NOW REMAINS IN ST. PETER'S

It is impossible to read the tale of the building of St. Peter's without wishing very sadly that either Bramante or Michelangelo could have finished it, or, at any rate, that after Bramante's death his very able plans might have been carried out. There is very little left now of the original exquisite and restrained design he made, save the idea of the dome. For in 1564 Vignola added cupolas in place of Bramante's towers, and Maderna, an architect of the early seventeenth century, for the last time opposed the Greek cross plan, pulled out the nave to make it in form a Latin cross, and added the chief front.

The last architect to set his mark on St. Peter's was Bernini. He built the magnificent entrance piazza, a great wide circular sweep, with its fourfold arcade of huge pillars. This fine empty space before the chief façade is of the most wonderful value, as it frames and sets back the great church. St. Peter's is an awe-inspiring sight, and fully half of the effect, to the approaching visitor standing by those immense pillars, is caused by the sweep of Bernini's piazza.

Everything about St. Peter's is huge. The dome is twice as high as the towers of Westminster. The pillars that run round the actual building are immense. The church's interior is almost oppressive in its magnificence.

THE MEN WHO COPIED THE STYLE OF MICHELANGELO

Michelangelo had done many other architectural works before he touched St. Peter's. His labors had been varied, from the staircase at the Biblioteca Laurenziana, Florence, which Vasari finished from his design, to the Medici Mausoleum. His greatest civic building was the Capitol at Rome. Another work of his in the great city was the turning of a Roman bath-house into the Church of Santa Maria degli Angeli.

After Michelangelo another change came over Renaissance architecture in Italy. The great genius had a number of followers who imitated his restless, tormented grandeur, and could not in their smallness get at the strength that underlay his style. In the seventeenth century architects began to have a horror of simple, classic lines, and they felt that the more curves a building had, the better it was. To this period, that of the degeneration of Renaissance style, which corresponds in architectural history with the last eccentricities of Gothic, the name of Baroque, or Rococo, has been given. It is, as we may guess, not a good architecture. But in spite of its real weaknesses some interesting Baroque work was produced in Venice and the neighboring cities.

THE GLORY OF VENICE IN THE FIFTEENTH AND SIXTEENTH CENTURIES

In Venice, the fairy city set in the sea, palaces of dazzling beauty mark the Renaissance period. Like Florence, Venice was an independent power and had much wealth which she joyfully expended in the interests of art and architecture. Palaces arose in the Gothic and Renaissance period as a matter of course, just as nowadays in a thriving American city huge stores would appear. The standard of the Venetian was high; nothing paltry or cheap was allowed to appear; we can scarcely conceive of the glory of fifteenth- and sixteenth-century Venice.

The city had, of course, a charm of her own, which, apart from the strong, individual taste of the Venetians, gave distinction to her architecture. No other Italian palaces were lapped by tides which flung up an added radiance into the sun's light and drew down the lines of walls and doors in long, wavering reflections, and painted them in the richness of color that tranquil water alone can give.

It was because sky and sea made such a glory of the marble lines that Venetian architecture in the years of wealth became so decorative. Surface ornament was peculiarly rich in the Baroque period—too rich. Balconies flung out their tra-

ceries against gleaming walls; cornices running the length of stories cast bands of blue shadow aslant the palace fronts.

We have already noted, in mentioning San Marco, how independent was the Venetian spirit. When Renaissance architecture rose in the city her artists and architects created not only this rich surface effect, but a design for grouping their windows which is very pleasant and sets them apart from other Italian palaces of the period. They placed a cluster of windows in the middle of a façade, with bare wall on either side making the group appear the richer by contrast.

THE LOVELY CITY THAT STANDS ON A NETWORK OF CANALS

To go along the Grand Canal, which is the main street of Venice, almost lined with palaces, and across the wonderful Rialto Bridge, is to receive an unforgettable impression of Venetian genius.

As in other Italian towns, it was often difficult to decide whether a Venetian's work entitled him more to the description of architect than sculptor. The two arts almost always went together; many men have laid the stamp of their dual gifts on Venice. In the sixteenth century two great names stand out—the gifted Lombardi family and Jacopo Tatti, generally known as Sansovino. To Pietro Lombardo is due, among other notable works, the lovely marble Church of Santa Maria dei Miracoli, one of the most exquisite things the Renaissance produced in Venice. To Sansovino, again among other notable works, the city owes the Library of San Marco, the greatest civic building produced in Italy in this period. The School of San Marco, now a hospital, was built by one of the younger Lombardi.

Many architects were concerned in the most famous house in Venice, the Palace of the Dukes, or Doges. Like the Vatican, it took centuries to grow. It was begun early in the ninth century, was twice burned down and rebuilt, and suffered many alterations. The façades date from the Gothic period (Bartolommeo Buon was responsible for some of their early beauty), and each successive generation added something. The great courtyard with its arcade is one of the most delightful things in Italy, and is unique in the architecture of the period.

The palace is built of various kinds of marble. In places rose and white blocks make a pattern of color which, added to the open tracery and richly carved columns, creates an exquisite effect. In due course Pietro Lombardo was employed on the palace, and after him Bergamasco, and, later, Scarpagnino, another architect. From the courtyard rises the famous Giant's Staircase, and here Sansovino, working in the capacity of sculptor this time, placed the fine figures of Mars and Neptune. Paul Veronese and Tintoretto painted some of the walls and ceilings of this famous palace, whose doorways and chimney-pieces are wonderfully carved. At every third step, it seems, one is confronted by a great work of art. The Bridge of Sighs, its gleaming shape hung over the waterway, connects the palace with the prison.

The last great architect of the later Renaissance was Andrea Palladio, a man of great gifts who has had a considerable effect on Europe. Some of his works were carried out in Vicenza; many others were begun, but did not reach completion.

THE FINE THINGS PALLADIO MADE FROM HIS POOR MATERIAL

Palladio had often to build in poor material, such as brick faced with stucco, and it was a mark of genius that out of such commonplace material he should have created works of art. He published a famous work on architecture which contained a history and description of buildings since destroyed, and also designs for his own buildings.

Palladio built many palaces in Vicenza, and added the famous arcades to the old basilica in that town. One of his best-known works was the Redentore Church, Venice.

Soon after Palladio's death buildings in the Baroque style began to be seen. Probably the most famous of all Baroque buildings is the Santa Maria della Salute Church in Venice, built by Longhena. Bernini, whose piazza for St. Peter's we have already mentioned, was a Baroque architect, one of many who labored in Italy, not altogether for its good, in the seventeenth century.

All countries and races have to pay the price of a great period in art by the poor work which inevitably follows it. And perhaps we can appreciate pure Renaissance buildings in Italy all the better because we are obliged to pass by so much that is unworthy of them.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6489.

FRENCH—A VISIT TO THE LOUVRE

First line, French; second line, English word; third line, as we say it in English.

Jeannette elle est malade. C'est tout à fait ma faute. Cela me fait de la peine.
Jenny she is ill. *This is entirely my fault.* *That me makes of the sorrow.*
Jenny is ill. It is all my fault. I am very sorry.

Hier maman nous a conduits au Louvre pour voir les tableaux.
Yesterday Mamma us has conducted to the Louvre for to see the pictures.
Yesterday Mamma took us to the Louvre to see the pictures.

Les galeries sont très longues et glissantes. C'est bien la place pour glisser.
The galleries are very long and slippery. *This is very the place for to slide.*
The galleries are very long and slippery. It is just the place for sliding.

Jeannette et moi, nous avons glissé d'un bout à l'autre de la salle.
Jenny and I we have slid from one end to the other of the room.
Jenny and I slid from one end of the room to the other.

Maman a crié: "Prenez garde!" Il était trop tard. Jeannette était tombée.
Mamma has cried: "Take care!" *It was too late.* *Jenny was fallen.*
Mamma cried: "Take care!" It was too late. Jenny had fallen.

Elle n'a pas pu se relever. Elle a crié: "Ma jambe! Ma jambe!"
She (not) has not been able herself to raise. *She has cried: "My leg! My leg!"*
She could not get up. She cried: "My leg! My leg!"

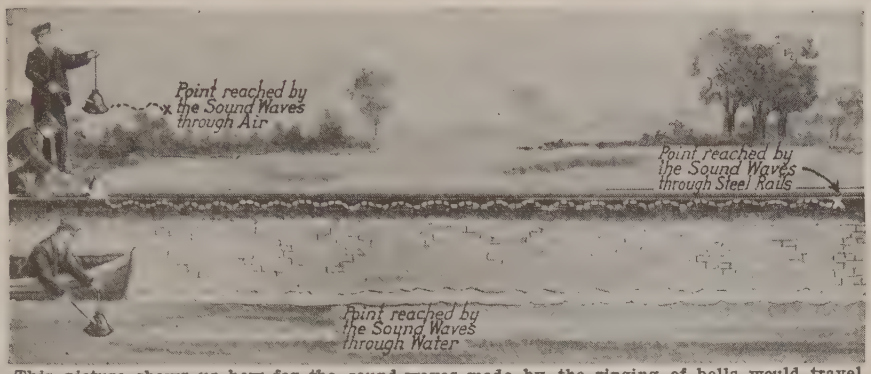
Un monsieur a dit à maman: "La petite fille s'est-elle fait mal?"
A gentleman has said to Mamma: "The little girl herself is she made ill?"
A gentleman said to Mamma: "Has the little girl hurt herself?"

"Je crains que la jambe ne soit cassée." Le monsieur a examiné la jambe.
"I fear that the leg not be broken." *The gentleman has examined the leg.*
"I am afraid that her leg is broken." The gentleman examined the leg.

"Elle s'est foulé le pied. Elle ne doit pas marcher pendant quelque temps."
"She herself is sprained the foot. She (not) must not to walk during some time."
"She has sprained her foot. She must not walk for some time."

Nous l'avons mise dans une voiture, et nous sommes rentrés à la maison.
We her have put into a carriage, and we are returned to the house.
We put her into a carriage and returned home.

THE NEXT FRENCH STORY IS ON PAGE 6374.


Point reached by the Sound Waves through Air
Point reached by the Sound Waves through Steel Rails
Point reached by the Sound Waves through Water

This picture shows us how far the sound-waves made by the ringing of bells would travel through air, steel and water in a certain given time if the bells were all struck at exactly the same moment.

THE WAVES OF SOUND

CONTINUED FROM 6082

IN order to have light it is necessary that there shall be not only something outside our bodies, but also an eye to see that something. All nature is in darkness except where there are eyes to see. In the same way, "the silence that is in the starry sky" is never broken on the earth except where there are ears to hear. We are now going to study the something outside ourselves. We may call that something Sound, but it is not really sound till there is an ear to hear it.

As light is a wave motion, so is sound, and certain facts which are common to all kinds of wave motion are therefore true of both light and sound. But otherwise the differences between these two kinds of wave motion are very great. Anything that carries, or conducts, or conveys, we may call a *medium*, which really means the "thing in the middle." Sound, then, unlike light and radiant heat, is a wave motion in a material medium. This medium is often air, but it may be a gas or mixture of gases; it may be a liquid, or it may be a solid body.

Where there is no matter there can be no sound, for sound is not conveyed by the ether. It follows that no disturbances on the sun or the moon could ever produce a noise that we could hear, because beyond the limits of our atmosphere there is nothing but the ether between us and these heavenly bodies, and though the ether conveys light, it cannot convey sound for us to hear.

When we say that sound is a wave motion, or a vibration, we make a statement which anyone will agree is true who has seen or felt what happens when sound is produced. For instance, we may hold a piece of string tightly, one end in each hand, and then suddenly pull it. It will actually be seen to vibrate as it produces a little musical note.

The same is true of a piano wire. If we touch a bell that has been sounded we can feel that it is vibrating; also we know that, in such a case as that of a tumbler which has been struck, the finger which stops the vibrations stops the sound at the same time, proving that the vibrations are the cause of the sound. Every time the string or the bell moves there is produced a series of waves which reach our ear and become sound.

It is easy to prove that the air, and not the ether, conveys these waves. We may put an electric bell in a transparent vessel and set it going, and then we may start to draw the air away by means of an air-pump. As we reduce the amount of air surrounding the bell our sight of the bell is not affected, be-

cause we see it by light which travels through the ether; but the sound of the bell gradually becomes fainter, until at last it ceases. The bell itself is vibrating as it was before, but if there is no longer any air round it, it cannot create the waves we call sound. Then, if the air is gradually admitted again, the sound will return. This simple experiment teaches us not only what it is that conveys sound, but also that the loudness of sound depends largely on the state of the air.

WHY SOUND TRAVELS MORE QUICKLY AT ONE TIME THAN ANOTHER

When we compare the speed of light and sound we find a great difference. We see the puff of smoke from a distant cannon some seconds before we hear the report of the explosion. Light travels so fast that, however distant the gun is, we see the flash in fractions of a thousandth part of a second. But sound travels comparatively at a slow speed. The speed of light and of radiant heat is always the same in any circumstances, so far as we can discover. This, however, is not at all true of sound, the speed of which varies considerably with different circumstances.

We may notice at once that, fortunately for the art of music, the speed of sound varies only in very small degree with its pitch or with its loudness. It would be a very serious matter for the hearing of music if, when we were listening to an orchestra, the sound of the flutes reached our ears a beat or two before the sound of the double basses when the composer meant us to hear them together; or if a tune, being loudly played by one part of the orchestra and softly accompanied by another part of it, reached our ears before or after the accompaniment.

WHY A NOISE WILL TRAVEL FASTER THROUGH IRON THAN THROUGH AIR

The ordinary speed of sound through air is about 1,100 feet a second. As the temperature of the air rises it becomes slightly more elastic; it rebounds better when struck, so to speak, and therefore the passage of sound through it—which entirely depends on the elasticity of the air—is made easier. The speed of sound, therefore, increases somewhat with a rise in temperature of the air, so long as the air is of the same density. If we understand this principle of elasticity we shall see why it is that sound passes more rapidly through liquids than through gases, and still more rapidly through solids.

Such a metal as iron, in the solid state, has much greater elasticity than air, and sound will travel through it about seventeen times as fast as through air. This means that waves of the same shape which pass through air pass in and through the solid iron. In order to avoid a possible confusion here about "speed" we must just explain that the pitch of a musical note depends on the number of waves striking the ear in a second. This is quite a distinct question from the rate at which the waves travel through the air or anything else.

A given sound conveyed through iron will reach the ear about seventeen times more quickly than when conveyed through air, but its pitch will be the same in both cases, because the number of vibrations occurring in each second is the same in both cases, though they get through the iron so much more quickly.

WHY WE HEAR WELL ON A CLEAR AND FROSTY NIGHT

When we come to study the loudness of sound we find that the first law about it is the same as the law of other wave motions, such as radiant heat or light.

In the exact language of science, the law is that *the loudness of sound varies inversely as the square of the distance*. This is simply a neat and quick way of saying that, if we walk three times as far away from the source of the sound as we were before, its loudness will be, not one-third of what it was, but one-ninth of what it was, nine being the square of three. The square of a number is the number multiplied by itself.

That is all there is to say about the power of such things as light and gravitation; but in the case of sound other things come in, for the density of the medium which conveys it is very important. On a frosty night the air is very dense. One consequence of this is that a motor car runs better, because the engine gets a better supply of oxygen. Another consequence is that sounds are heard more loudly.

At the seashore, when we watch the waves rolling up against the breakwater or a cliff, we know that they may be reflected, or "bounced back." Often the waves may be broken up, and what happens will depend on the kind of surface they strike against. But if it is a smooth, flat surface, we see that the waves are reflected from it, almost as a ball is from

a wall. Now, if sound is really a wave motion, we should expect that it could be reflected as the waves of the sea may be; and this is indeed the fact, as we shall soon see.

All wave motions can be reflected. What is true of sound is as true of radiant heat and light as of the waves of the sea. There are certain laws which apply to these very different cases. The first, stated in scientific language, is that *the angle of incidence and the angle of reflection are equal.* This means that the angle at which the wave approaches the surface is the same as the angle at which it will leave the surface. The same applies to a billiard ball striking the cushion of a billiard table or to throwing a ball against a wall. If we throw the ball straight at the wall, it comes back straight, except for the influence of gravitation; if, on the other hand, we throw it slantwise, it comes off the wall slantwise.

This is equally true of sound and radiant heat and light. One of the points to notice is that the level, or plane, as we say, in which the wave approaches the surface is the same as that in which it comes off. For instance, suppose the sound were running along on the level of this paper, and then struck obliquely (or slantwise) a wall at the edge of the paper, it would come back not only at the same angle at which it approached the wall, but still traveling on the level of the paper—not bent upward or downward so as to travel either above or below the level of the paper.

This is true also of light and radiant heat. We all know that sounds seem different in the open air when compared with sounds in a closed room; we know how different our voices sound in different places. All this is a question of the reflection of sound. The most striking way in which we can prove to ourselves that sound is reflected is in hearing an echo.

One of the ways in which we can test for ourselves the rate at which sound moves is to make a sound at a certain distance from an echoing surface and then notice how long it takes the echo to reach our ears. There are echoes in nature besides those we make ourselves,

In the Dome of St. Paul's, London—listeners testing sound in the Whispering Gallery.

and the best instance of reflection of sound causing an echo is a peal of thunder.

Thunder is a sound formed by a disturbance in the air made by the passage of lightning from cloud to cloud or from cloud to earth. If there is no echo, we simply hear a single clap of thunder. When we hear a peal we simply hear that clap of thunder echoed again and again from cloud and earth.

THINGS THAT MUST BE REMEMBERED AT GREAT MEETINGS AND CONCERTS

In places made for speaking or for music echoes are often a great nuisance. All our success in listening to a speaker and all our pleasure in listening to music depend on the absence of any echoes that can be noticed. In a famous auditorium it was almost impossible to hear music with pleasure because of the echoes from its great round wall. When a player struck a single chord on a piano, it sounded in almost every part of the hall like a quickly repeated chord.

The case is still worse in listening to a speaker, because everything depends on our hearing each syllable, apart from any echoes of words previously spoken. Many devices have to be adopted in order to prevent, as far as possible, the reflection of sound in such cases. Tapestries and hangings, and so on, are bad reflectors of sound, and may be of service; wires stretched across the hall above the heads of the audience may often help to break up the sound-waves, so that they are, at any rate, not reflected from the roof.

TWO MEN WHO TALKED TO EACH OTHER WHEN A MILE APART

The people themselves, by their mere presence, improve the properties of a hall for speaking and singing, because their bodies form a broken surface for the floor of the hall, and the sound-waves are broken up as the waves of the sea are broken up when they strike an irregular cliff as compared with a flat breakwater. Therefore it sometimes happens that when the audience in a hall is small the speaker has more difficulty in making himself heard than when the hall is quite full.

When the surfaces are far away from the speaker or the musician, time is taken in the reflection, and so a distinct echo is heard. But if the sound is produced close to a curved surface, as in the case of many churches, the echo occurs so quickly that, instead of being heard by the ear as an echo interfering with everything, it blends with the sound of which it is an echo and simply makes it more clear.

There are other ways in which the principle of echoes can be turned to good account. It is recorded that two Arctic explorers talked to each other at a distance of over a mile. Their voices were beautifully reflected from the smooth sheet of ice between them.

The Whispering Gallery of St. Paul's Cathedral, London, and the echoes in the dome of the Capitol at Washington, as well as similar effects in the National Hall of Statuary, are illustrations of the same thing. The principle of echoes, or the reflection of sound, is invaluable in every case where we employ anything in the nature of a trumpet. The use of the outer ears of animals depends on the reflection of sound, as do the artificial ear-trumpets made for deaf people. Sound is reflected from side to side of the ear or the ear-trumpet until it reaches the place where it is to be heard.

We know that light may not only be reflected but also bent, or *refracted*. That is what happens when we concentrate the light of the sun by means of a burning-glass on a piece of paper; and it also happens in many other cases. Now, it is very interesting to discover that sound can be refracted in its course, as light can. The refraction of light is extremely important; the refraction of sound is of no practical importance, but is interesting because it teaches us about wave motion.

AN EXPERIMENT WITH A SWINGING BALLOON AND A WATCH

If we take a big bag or balloon and fill it with carbon dioxid, we find that this bag acts toward sound as a lens acts toward light. The sound-waves will be bent by the gas in the balloon, and they will be brought to a focus on the other side of the balloon, just as sunlight may be brought to a focus on a piece of paper by means of a burning-glass.

Thus, as in a well-known experiment made by Lord Rayleigh, a great student of sound, we may stand opposite a watch at such a distance that we can hear nothing. But if a balloon filled with carbon dioxid is made to swing slowly from side to side between us and the watch, and if we are just at the right distance, then, when the balloon is in the middle of its swing, and focuses the sound-waves, we shall hear the watch ticking.

THE NEXT STORY OF THE EARTH IS ON PAGE 6437.

HOP-O'-MY-THUMB

CONTINUED FROM 6205

A WOODCUTTER and his wife, who lived on the borders of a huge forest, had seven children. They were all boys, and the youngest of them was so tiny that his father called him Hop-o'-my-Thumb.

Once the woodcutter and his family had been well off, but the time came when things got so bad that the poor man began to wonder if he would always be able to find enough food for them to eat.

Now, although Hop-o'-my-Thumb was the youngest of them all, he was very shrewd and wide awake, and he knew quite well what it was that made his father and mother so anxious.

One evening as he lay awake in his little bed he heard them talking in the parlor below.

"I cannot bear to see my children starve," his father was saying. "Tomorrow I shall take them out into the forest and leave them. Perhaps someone may find them and feed and care for them."

But the mother burst into tears. "How can you be so cruel?" she sobbed. "If they are to die, better that they die here, where no greater harm can befall them."

But the father would not listen. He, too, loved his children dearly, but he could not bear to see them die before his eyes. And so the plans for the morrow were made.

Hop-o'-my-Thumb was very wide awake indeed by this time, and before he went to sleep he, too, had made his plans. Early in the morning, before even the birds were awake, he ran down to the brook and filled his pockets with little white pebbles. Then he crept back to the house, took off his clothes, and jumped into bed again.

After breakfast their father told them they were to spend the day in the wood. The boys were delighted, and hurried off with shouts of laughter. But Hop-o'-my-Thumb managed to get behind the rest, and as he walked he carefully dropped his little pebbles all along the path.

Soon they came to a part of the forest where the trees grew thickly together. Here their father stopped, and set to work to cut down a tree. The little boys were told to tie up the faggots, and then, when they were too busy to miss him, the father stole quietly away. But it was not long before he was missed, and when they found themselves alone in the dense forest the boys were afraid.

But Hop-o'-my-Thumb smiled to himself.

"Have no fear," he said boldly. "Follow me, and I will lead you home."

Within a yard of where they stood was the last pebble that he had dropped; beyond it lay another—and another, and so, following the stones,

Hop-o'-my-Thumb led his brothers safely home.

While all this was happening their mother sat at home, thinking sorrowfully that she had seen her boys for the last time. Presently there was a knock at the door and in came a forester to say that his master, who had heard of their distress, had sent them a present of some venison. But before the poor woman could answer, she heard shouts, the door burst open again, and in ran the seven little boys.

"Here we are, mother!" they cried. "We lost ourselves in the forest, but Hop-o'-my-Thumb brought us home without taking one wrong turning."

Their mother was overjoyed to see them again, and when their father came home in the evening, after having wandered about all day, too miserable to face his wife, a happier family than theirs was not to be found.

But the venison did not last forever, and the day came when no food was left in the house but a loaf of bread. Hop-o'-my-Thumb knew this, and guessed what would happen. Sure enough, that same evening he heard the woodcutter tell his wife that once more he must take the children into the forest, in the hope that somebody rich and generous might find them and give them a home.

At daybreak Hop-o'-my-Thumb sprang out of bed and ran down the stairs, only to find, to his bitter disappointment, the door firmly barred and bolted. In despair he turned and made his way slowly back to bed. But at breakfast an idea came to him. Instead of eating his slice of bread he hid it in his coat, so that he might use the crumbs as he had used the pebbles to mark out the path.

Soon the father called the boys, and bade them go with him into the wood. Again, as before, he set them to a task, and then slipped away unnoticed.

The boys were not alarmed this time. "Hop-o'-my-Thumb knows the way," they said. But when Hop-o'-my-Thumb came to look for the crumbs that he had carefully strewn, there were none to be found! The birds had eaten them.

"Now we're in a pretty pickle," thought Hop-o'-my-Thumb. "Come, boys," he said aloud, "we can't stay here. It will soon be dark, and the wolves will be out."

They found a path and set out bravely. Soon the sun went down, and the shadows began to fall. Presently one of the brothers ran on a little way ahead.

"I see a light," he shouted suddenly. "Look! There is a house. Let us beg a bed for the night."

They ran and knocked at the door. A woman with a kindly face opened it. But when she heard what they wanted she shook her head.

"Alas," said she, "my husband is an ogre. He will be returning soon, and if he finds you he will kill you and eat you."

The boys trembled. "We dare not go out again into the dark forest," they said, weeping.

"Come in, then, you poor boys," said the woman, taking pity on them. "I cannot be sure that you will be safe, but I will do my best for you till morning."

She hid them away in a garret and left them. Presently the ogre came home. He made such a dreadful noise coming up the steps that one of the brothers peeped out of the window to see what was the matter. The ogre glanced up with a look so terrible that the little boy drew back in terror—but not before he had been seen.

Up the stairs into the room strode the ogre. But it was dark, and he could see nothing. He struck a match, lit a lamp, and held it up. In the corner, all huddled together, he saw seven frightened little boys with white faces. One by one he pulled them out and looked them up and down.

"They will make a fine supper when they are fattened up a little," said he to his wife. "Give them a good meal and put them to bed. See that they have plenty to eat for a week, and don't do too much running about, and by that time they ought to be fit to eat."

When the boys had had an excellent supper, they were taken into a room with two enormous beds. In one of these slept seven little ogresses, with seven gold crowns on their heads. Into the other crept the seven brothers. In the middle of the night the ogre woke up and, because food was his chief interest, he began to feel sorry that he had not killed the boys on the spot. He got out of bed.

"What are you looking for?" asked his wife.

"My dagger," answered the ogre. "I'll make sure of those boys. Boys are slippery customers—they may escape."

Now, Hop-o'-my-Thumb, who had not

closed his eyes all night, heard this. As quick as lightning he jumped up, snatched up the golden crowns, and put them on his brothers' heads; then he carefully put the boys' nightcaps on the ogresses' heads and scrambled back into bed just as the ogre came in. He went up to the bed where the seven little brothers lay, felt the golden crowns, and passed over to the other bed. Here he found seven little heads inside seven little nightcaps.

"Ah!" he said. And with one sweep of his dagger he slew them all.

HOP-O'-MY-THUMB GUIDED HIS BROTHERS SAFELY THROUGH THE WOOD

Immediately he had gone, Hop-o'-my-Thumb woke up his brothers, and out they all crept, just as the dawn was breaking. But before they could get very far away the ogre discovered what had happened.

"Bring me my seven-league boots!" he bellowed to his wife. With these boots he could go at a terrific speed. The boys saw him coming, and gave up all for lost. And, indeed, the ogre had nearly reached them, when his foot slipped, and he fell—right on to the huge dagger that he carried in his hand. The dagger ran into his heart, and with a groan he rolled over, dead.

Hop-o'-my-Thumb ran up to him, dragged off the seven-league boots, and put them on. Leaving his brothers in the care of some woodcutters who were passing, and who promised to take them home, he made his way in fifty strides to the palace. In the palace gardens Hop-o'-my-Thumb was fortunate enough to find the king, surrounded by a group of courtiers, deep in conversation. Hop-o'-my-Thumb hid himself behind some trees and waited his opportunity. The discussion was a serious one. It appeared that the king was in despair that he could not get a message to his generals, who were fighting a great army miles away, in time to be of service. Unless this message could be delivered without delay it would be useless, and the enemy would conquer. Suddenly, to everyone's amazement, Hop-o'-my-Thumb stepped out from his hiding-place, showed the king his magic boots and offered to carry the message faster than the swiftest horse. The courtiers were furious at his boldness, and would have thrust him out of the palace garden, but the king, who had taken a fancy to Hop-o'-my-Thumb, silenced them with a gesture, and gave his consent. Hop-o'-my-Thumb went, delivered his message, and returned in triumph.

From that day Hop-o'-my-Thumb's fortune was made, and he and his father and mother and his little brothers lived happily together ever after.

GERAINT AND ENID

A TALE OF KING ARTHUR'S COURT

ONE morning in early summer Queen Guinevere, with a lady at her side, sat on her horse and waited on a hill to watch King Arthur's hunting of a deer.

While they stood there, Prince Geraint —a comely and vigorous young man— rode up the hill and drew rein at their side. He was too late for the hunt, so he stayed with the queen, and watched the woods in the distance and listened for the braying of the hounds.

Presently there passed by the hill, on the winding road in the valley, a strange company of three—a knight, a lady, and a dwarf, who lagged behind. They were all mounted, and rode slowly, the noise of their horses' hoofs on the soft earth scarce rising to the hilltop. The queen, puzzled to know the name of the knight, sent her lady after the dwarf to inquire.

But when the lady returned she had a red weal across her face, and indignantly she told how the arrogant dwarf had first refused to tell his master's name, and then, when the lady would have ridden past him, had cut her across the face with his whip. At this Geraint clapped spurs to his horse and pursued the dwarf. But he, too, fared in the same manner. In his first rage Geraint laid hand to his sword, meaning to cut down the dwarf, but his noble nature rebelled against striking so weak a creature. Therefore he rode back to the queen, obtained her permission to ride after the knight who kept so unmannerly a follower, and then, armed only with a sword, set off to demand an apology for the insult.

He saw the three riders far ahead of him disappear over the crown of a hill, and, following, discovered a little town in the valley below, into which they had disappeared. When the young prince arrived in this town, no one would give him lodging or lend him arms, or, indeed, take notice of him. The smithies rang with the sound of the hammering, there was a hurrying to and fro, and he learned that a great tourney was to be held on the morrow.

At last, however, an old earl, who lived in an almost ruined castle, received the young prince, and the daughter of this earl, Enid by name, took Geraint's horse to the stable and waited upon him as he sat at meat. And Geraint loved her. She was fair, and the faded, simple dress she wore could not obscure the dignity and nobility of her soul. Much amazed to find this earl and the beautiful Enid living in poverty, Geraint told why he had come to the town, and the old earl, in return, told his story.

The knight whose dwarf had insulted him was called Sparrow-Hawk. He was a cruel and wicked man. He loved Enid, and because the earl would not give his beautiful daughter to so turbulent and bad a man, this Sparrow-Hawk had lied against the earl, had raised the town against him, and had even broken into his house and spoiled it of its once fair possessions. He had now built a castle in the town, and usurped all the privileges of the poor old earl.

Then Geraint craved leave to fight for Enid in the tourney, and the earl gave him leave, and Enid, who loved his noble face and quiet voice, was glad and happy. They found armor for him and made it ready for the great tourney, and he rode into the lists and overthrew all who came against him. And when Sparrow-Hawk fell before him, Geraint gave the bad knight his life only on condition that he rode to Arthur's court and craved pardon of the queen for the insult done to her.

And now for Enid came the happy days of preparing for her marriage. She would have worn a glorious dress worthy of King Arthur's court, but Geraint, who loved her, with a man's delight in pure simplicity begged her to wear the simple gown in which first he had seen her; and, thus dressed, she went with him to Caerleon.

They were most happy on that ride, and full of play, like children; and when she said, "What will the queen think of my ragged dress?" the young prince kissed her fears away, and with brave words made her less afraid of entering King Arthur's court. And all loved Enid when she came among them, and the queen clothed her for the marriage in dresses royal and magnificent, and Geraint was proud of his little, beautiful, dear wife, who had grown to womanhood in poverty and simplicity.

But soon after their marriage came those evil days when men said that Queen Guinevere loved Lancelot more

AS THEY STOOD ON THE HILL, A KNIGHT, A LADY AND A DWARF PASSED IN THE VALLEY

than the king, and the air of the court seemed full of whispering and slander. The noble Prince Geraint, brooding on these tales, hated to see his young wife laughing among the other ladies at the court, and determined to take her away. So long did he brood about the matter that he began to wonder if she loved him best; it seemed to him that her eyes shone as brightly for others as for himself, and that she was as pleased to talk with the other knights as with her own husband. Thus did the noble heart of Prince Geraint become first suspicious, and afterward bitter as gall. So he got permission of King Arthur to go to his own land, and there he dwelt with Enid, and gave himself up to loving her. But Enid, sorrowing that her brave lord had retired from his knightly life, blamed herself, and one night, in her sleep, she cried aloud: "Oh, me, I fear that I am no true wife!" Geraint heard her, and his soul staggered within him. He believed her false.

On the morrow he said roughly to her:

GERAINT AND ENID, RIDING THROUGH THE WILDS, CAME UPON A YOUNG LADY WEEPING

"Put on your worst and meanest dress," and bade her get to horse and ride on ahead of him; and, whatever might happen, she was not to speak to him. So Enid did his bidding and wore the dress in which he had first loved her, whereat his heart grew sad. And thus they rode into the wilds.

And toward sunset Enid saw three tall knights waiting in ambush for her lord, and she rode back and told him. Geraint rebuked her for breaking silence, and went forward. He overthrew the knights, stripped them of their armor, which he laid upon their horses, and then, knotting the reins of the horses together, bade Enid drive them before her.

Shortly afterward Enid came upon a lady weeping over a knight who lay dead on the ground. She returned and told Geraint, and he rode up and said, "Lady, what has befallen you?"

"Noble knight," she replied, "as we rode through the forest three villains set upon my husband and slew him."

So Geraint rode on and overthrew the three false knights.

Then they came to a town and fell in with the great earl of all that territory, who had loved Enid years before. And

this earl entreated her to leave Geraint, who treated her so pitifully, and to become his own proud wife and dwell happily with wealth and honor. Enid, seeing that he would murder Geraint, promised and bade him come for her at dawn; but before the dawn she roused Geraint, told him the story, and they rode away. The earl and his followers pursued. Geraint slew the terrible earl and put his followers to flight.

But as they rode away Geraint suddenly swooned in his saddle and fell. Enid came back to him, and found him bleeding from an almost mortal wound. While she tended him, wailing because she thought him dead, the bandit Earl Doorm, with a great company, came charging by. The earl bade two of his men carry Geraint to his castle, and rode forward again. All day Geraint lay upon his shield in the castle of Doorm, his sword at his side, like a man dead. And at night a great feast was made in the castle.

It chanced that Earl Doorm, looking up from his eating and drinking, in the bright light of a hundred torches saw Enid sitting in shadow by the deathlike knight, and called her to his side.

"Eat!" he commanded.

"Not till my lord arises," said Enid.

"Drink!" cried Doorm.

"Not till my lord arises!" said Enid.

Then Doorm swore a great oath, and bade her think no more of a dead man. He offered to make her his wife, sent for gorgeous raiment, and told her she should rule over his land. But Enid shook her head, and replied she loved one only. Doorm laughed scornfully, and pointed at her sorry dress, as though to say, "How well he loves you!" And Enid answered that in that very dress her lord had first looked upon her and loved her. Wroth to the full, the turbulent earl strode toward her and struck her a buffet on the cheek. But at that moment Geraint sprang, sword in hand, from the shield, and with one stroke "shore through the swarthy neck" of Doorm. At sight of the head rolling on the floor, and at sight of Geraint, risen, as it seemed, from the dead, the people fled terror-stricken from the hall, and they were left alone in a great silence.

Then Geraint looked upon Enid, and she came toward him open-armed. Very softly he craved forgiveness of his wife. He had heard her words to Earl Doorm. He knew her now for his true wife. All suspicion was swept from before his eyes. He saw her in all her gentle sweetness and truth. Nevermore would he think ill of her; nevermore would he doubt her. She could only answer with her arms and her lips.

At that same moment they became aware of a sudden stir without, and, expecting danger, went forth, to find King Arthur and his knights before the castle. The king had come to punish the wicked bandit earl, and Geraint found himself once more, happy and glad, among his friends. And Enid lived to be known by all people as Enid the Fair and Enid the Good, and Geraint loved her to the end of their days.

THE DOG AND THE WOLF

A LEAN, half-starved wolf happened one night to meet a dog who was well fed and looked happy.

The wolf said: "How well you are looking! I really never saw anyone looking so well. How is it that you are so well fed? I run into danger much more than you do to get food, and yet I am almost starving."

"Why, you may live just as well as I do if you will do the same work."

"Indeed, what is that?" asked the wolf.

"Only to guard the house at night, and drive away thieves," answered the dog.

"That will just suit me," replied the wolf, "I shall be only too glad to exchange my rough life for plenty of food and a good roof over my head."

Then the wolf saw a mark round the dog's neck and asked what it meant.

"Oh, that's nothing," said the dog. "But if you must know, my master ties me up in the daytime for fear that I should bite people, and I am only let loose at night."

"Thank you," replied the wolf. "You may keep your comfort to yourself. I would rather be free than be well fed under such conditions."

It is better to be poor and free than to be rich and a slave, says Æsop, the author of this fable.

THE CROCK OF GOLD IN THE PLAIN OF YORK

UPSALL CASTLE now lies in ruins on the Hambleton Hills overlooking the great plain of York. Some time ago a man who was living near the castle had a strange dream, three nights running, that if he went on foot to London Bridge and stood there waiting he would have some good news. So he took a wallet and a stick and walked to London, and stood waiting on London Bridge until he was tired out. Just as he was going away a Quaker came up and asked him why he stood there.

"Because of something I dreamed," said the Yorkshireman.

"Oh, I don't believe in dreams!" said the Quaker. "Why, only last night I dreamed that there was a crock of gold buried under the elder tree in the corner of Upsall Castle!" The Yorkshireman hurried back to Upsall, and began to dig under the elder tree. There he found a pot full of copper coins. On the pot was written:

Look lower! Where this stood
Is another twice as good.

He dug lower, and discovered a chest full of silver, and on it was written:

Look lower! Where this stood
Is another twice as good.

So he still dug on, and found the gold.

THE FAIRY HORN NEAR GLOUCESTER

ONE hot summer day an outlandish knight set out from Gloucester and lost his way in the great forest. He grew very weary and hungry, and meeting a woodcutter, he asked him where he could get meat and drink. The woodcutter led him to a green mound, and said: "If you will ascend this mound, and cry 'I thirst!' the fairy cupbearer will appear."

The knight did as he was told, and a cupbearer clad in a rich crimson dress sprang out of the mound bearing a large horn cup set with gold and jewels, full of fairy wine. When the knight drank the nectar, all his thirst and weariness left him. The cupbearer courteously waited for him to return the fairy horn, but the knight rudely rode away with it.

As soon as the Earl of Gloucester heard of this he pursued the knight and slew him. The cup, presented by the earl to the king of England, was lost.

THE ENCHANTED CAVE OF RICHMOND HILL

MANY legends are told of the brave deeds of King Arthur and his knights, and in Yorkshire there is the legend of an enchanted cave beneath Richmond Castle, where the king and his knights are laid to rest. It has been seen but once—by a potter named Peter Thompson, who was one day wandering round the hill of Richmond Castle. He entered a ravine, at the end of which stood a huge boulder. Climbing over it, he saw a glimmer of light, and came to a lofty cavern glittering with crystal, spar and stalactite. On a rocky couch lay King Arthur, clad in armor, with a jeweled crown upon his head and a diamond-hilted sword beside him. Around him lay his knights asleep.

Peter Thompson drew the sword half out of its scabbard, but the sleeper showed signs of awakening, and he rushed in terror from the cave. As he went a hollow cry came from within:

Potter, Potter Thompson,
If thou hadst either drawn the sword or blown the horn,
Thou'dst been the luckiest man that ever yet was born.

Terrified, he ran home. Many times he tried to find the cave again, but failed; but they say the king and his knights still sleep beneath the Castle hill.

THE PARSON AND HIS CLERK AT DAWLISH

A PARSON and his clerk, riding one stormy night toward the pretty village of Dawlish on the Devon coast, lost their way. It was the clerk's fault, and the parson said to him: "I'd rather have the Evil One for guide!"

A strange horseman at once appeared and offered to direct the lost travelers. Just before reaching Dawlish they passed a brilliantly lighted mansion. The strange horseman invited them to enter, and provided them with a splendid breakfast. But when the parson and his clerk came out of the mansion and tried to ride away, their horses would not move. "The Evil One take the brutes!" said the parson.

"I will," replied the horseman, lashing the horses over the cliff into the sea, where their riders changed into two rocks, now called the Parson and his Clerk.

THE NEXT STORIES ARE ON PAGE 6473.

Anchor of the battleship Maine, now in Reading, Pennsylvania.

NAVAL HEROES OF YOUNG AMERICA

CONTINUED FROM 6248

WHEN war broke out between the colonies and the mother country, England was mistress of the seas. Her ships went everywhere and her colonies could send their merchantmen into any port open to them under England's protection. But when they were at war with her, all this was changed. The colonies had to fight their own battles and look after their own ships at sea. The colonists owned many trading ships, but they had never had any reason to build ships of war for protection.

They had little difficulty in gathering together a crude army. Soldiers were in the field at a moment's notice. But to get a navy able to fight the English men-of-war was not such an easy matter. It took a long time to build ships for warfaring, and the expense of fitting out vessels for action was great—greater than the colonists could then afford. So when troubles between the colonies and the mother country began, the colonists had not a single ship large and strong enough to meet any one of the British fleet.

But there was a crying need for naval protection of some kind. Coast towns were open to attack by the enemy, and ships carrying American troops and supplies must go unharmed from one place to another. It was a trying situation for the struggling colonists, but they planned to make the best of it. So they allowed hundreds of small boats to be fitted out by private persons. These boats, called privateers, by attacking English merchantmen made it necessary for the British fleet to guard them; and the more warships were used in this way, the less they could be used to attack American commerce. The privateers helped the colonists somewhat, for commerce could be carried on after a fashion, though with some risk.

But, after all, this was but a makeshift of a navy. Something better was soon needed, and the colonists could no longer close their eyes to the fact. The first session of the Continental Congress had said nothing about ships, but by the time the second session met, the situation was felt as serious and a Marine or Naval Commission was appointed "to consider, inquire and report with respect to the organization of a naval force."

Fortunately for the colonists, there was one man among them, a Virginia planter, whose early life as an English seaman made him able to advise them about the kind of ships that would give the best service in the war. The name of this man, a native of Scotland, was John Paul, but after he came to America he added Jones to his name. The Commission invited him to come to the meeting, and he went.

They met at Philadelphia. Paul Jones gave them excellent advice as to the choice of ships and men for the

navy. He showed them that they could not hope to fight for the mastery of the seas with England. Only three nations had had fleets strong enough to do that, and these fleets had been the growth of centuries.

The colonists' vessels should not be too large or too small. What was most needed was frigates rating from thirty-two to thirty-six guns. He thought a squadron of four, five or six of such ships should be constantly kept in British waters and do the kind of sea warfaring that harasses the enemy most. Last of all, one sharp encounter, with the prize taken into some French port, would attract the attention of all Europe and raise the colonists in European eyes more than any battle on land would do. Congress took the suggestion, and on December 13, 1775, ordered thirteen frigates built.

THE SMALL BEGINNING OF A GREAT NAVY

While at Philadelphia the commission asked Paul Jones' judgment about some ships which Congress had an opportunity to buy. There were about twenty of all sorts and sizes, and they lay moored a short distance from the wharf. He found four fit for service—two ships, the Alfred and the Columbus, and two brigs, the Andrea Doria and the Cabot. Congress bought them, and these four merchantmen, made useful as warships, formed the foundation of our American navy. Esek Hopkins, now almost forgotten, was made commander-in-chief.

With these and other weak ships Hopkins did something to oppose the strong British navy. One of his lieutenants, a former captain of a merchant ship, John Barry, in the Lexington captured the Edward, the first ship taken. He later had command of the Raleigh. Paul Jones, after some small successes, left to carry the war into British waters.

THE ENGLISH CALL JOHN PAUL JONES A PIRATE

He attacked the forts at Whitehaven first, then landed on the Scottish shore, alarming the people wherever he went. The British were exasperated at the daring of this man, whom they insisted upon calling a pirate. There is no telling what harm he would have done to the enemy if his plan to go right around the British Isles had not been changed. While crossing the Irish Channel, however, he met the British sloop of war, the Drake. After some sharp fighting he captured her and brought her with great pride into a French port. She was a vessel of greater force than the American boat, and when the prize was brought in the Frenchmen could scarcely believe their own eyes.

This was not enough. He still had in mind an expedition that would give him the longed-for chance for one good sharp encounter with the enemy. That would make a lasting impression. The Drake was only a small boat, as was the Ranger. His victory had amazed France, but he meant the next time to startle the world.

THE FRENCH KING PRESENTS HIM WITH A SHIP

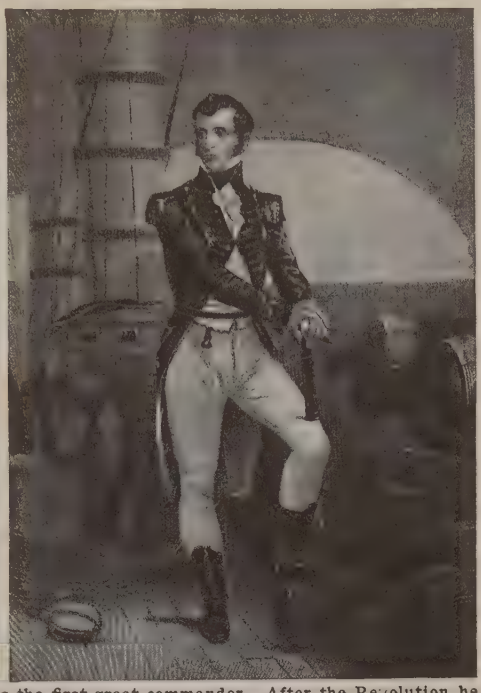
With his object in view he did all in his power to gather together a squadron of ships. France could give him little help, as she was at war with England and needed all her boats for service. Benjamin Franklin, who represented the United States in France at that time, did what he could to help. But there was little money at his disposal, and Congress could not spend any more then for ships. As a last resort he appealed to the king. Louis XVI, in spite of his own pressing need of boats, gave him a large vessel. She was the Duras, an old merchantman. He immediately changed her name to the Bon Homme Richard, in honor of his friend Benjamin Franklin. Within three months from the time she was given to him he had a squadron of five ships ready and was off to sea.

They spent the summer cruising about the British coast, and this contemptible little squadron, as one Englishman called it, did much more to alarm and annoy the people than the whole French navy had been able to do. One morning a British convoy of forty sail was sighted off Flamborough Head. They were merchantmen bound for Scarborough Head under protection of two men-of-war, the Serapis, Captain Pearson, and the Countess of Scarborough, Captain Piercy. Captain Jones immediately gave chase and ordered the rest of his ships to fall in line. The British fleet crowded sail and got away, but the men-of-war accepted the challenge and came up to fight.

THE BON HOMME RICHARD VICTORIOUS IN A GREAT FIGHT

There was work ahead, indeed. Naval history does not record a more determined and terrible struggle. At one time firing

NAVAL HEROES OF THE YOUNG NATION



John Paul Jones, whose real name was John Paul, was the first great commander. After the Revolution he served in the Russian navy, and finally died in Paris. His body is now buried at Annapolis. Lord Nelson, England's greatest naval officer, said that Stephen Decatur's exploit in the harbor of Tripoli was the "most daring act of the age." This brilliant officer was killed in a duel with another naval officer.

William Bainbridge served under Decatur at Tripoli, and afterward commanded the Constitution in her famous fight with the Java. He was an excellent officer in every respect. Thomas Macdonough's victory on Lake Champlain was as brilliant as any of the war, but the Americans had become accustomed to success by the time it occurred, and so it did not attract so much attention as some of the others.

on the Bon Homme Richard ceased and Captain Pearson asked if the Bon Homme Richard had surrendered. "No, I have not yet begun to fight," answered Captain Jones.

It was soon clear to the American captain that his only chance of success was to board the enemy's boat, if possible, and fight it out, man to man. Skillful manœuvring brought the two boats side by side, and as the Bon Homme Richard grazed the Serapis the fluke of one of her anchors caught fast in the mizzen chain of the Bon Homme Richard. Captain Jones lashed the boats quickly together and in this way made the grapple he had tried so hard to effect and Captain Pearson had tried so hard to avoid. Captain Pearson struck his own colors. The next day the Bon Homme Richard sank in spite of every effort, yet she captured the ship that sunk her.

At the end of the war with England the Americans had but one warship left, the Alliance, and she was sold for a merchantman the next year. It was clear that the new nation meant to get on without a real navy. Only a few tiny boats were kept. In spite of the heroic work done upon the seas the people thought a large navy unnecessary.

Trouble with France came first. France was still at war with England and looked to the Americans to protect the French West Indies. Washington was determined to avoid joining in the quarrel, and France then attacked our ships.

American ships victorious in our war with France

Three frigates, the Constellation, the Constitution and the United States, had been built in 1794. The senior officer with the rank of commodore was the same John Barry who had done good work during the Revolution. Congress soon had this infant navy in West Indian waters. Two sharp encounters taught the French that the little squadron had to be reckoned with. The Constellation, Captain Thomas Truxton, met the French frigate L'Insurgent off St. Kitts, and after several hours' hard fighting compelled the French ship to haul down her flag. Just one year later the Constellation silenced the frigate La Vengeance in a few hours, and made her strike her colors. Both English and French seamen were amazed. The French soon came to terms.

The war with the pirates of Tripoli

The clash with France was scarcely ended before the Americans' love of peace was again sorely tried. For a long time pirates from the Barbary States had been preying upon the commerce of all the Christian nations. The countries of Europe had paid tribute to these sea robbers as a means of protection, and the United States did the same. But the more the United States paid them, the more dissatisfied these pirates became. There was nothing left to do but to fight it out. War was declared and the Americans soon had a squadron in the Mediterranean under Edward Preble. Stephen Decatur, William Bainbridge and Charles Stewart did some brilliant work.

When the Philadelphia, Captain Bainbridge, ran upon a reef in the harbor of Tripoli she fell into the hands of the enemy and made a fine addition to their naval force. Stephen Decatur offered to go into the harbor and destroy her. Now, the Philadelphia lay close to the shore with a pirate crew and surrounded by hundreds of the enemy's guns. In the face of all these odds the young Decatur, with seventy men, reached the ship, boarded her and overpowered the crew. In a few minutes the Philadelphia was ablaze and Decatur with his men were on their way back midst a storm of shot and shell.

All this time the United States restlessly held her peace with England, but trouble with her was not long to be avoided. England in her life-and-death struggle with France had kept many of the French ships in port, and most of the carrying trade of the world was done in American merchantmen. If they risked a voyage to a French port, they were likely to be seized by an English man-of-war, and if they were bound for an English port, they were likely to be seized by the French.

England stops American ships

The Americans were exasperated at the situation, but the feeling grew worse when England stopped American merchant vessels, when and where she chose, and carried off seamen she claimed were British subjects. American wages were so high that thousands of British seamen had deserted and signed on American ships. Most countries then did not

agree that a man could change his citizenship, and Great Britain not only took off many recent deserters but also many who had naturalization papers, and some who were American-born. This caused great irritation. War was declared in 1812.

Brilliant as the naval victories of the Americans had been whenever they were brought to fight, the country placed its chief reliance in this war on the militia. The idea that our naval ships were able to meet those of the English seemed ridiculous, and not without reason, for we had only a few ships as against England's fleet of many hundred and her poor opinion of our "fir-built things with a bit of striped bunting for a flag at the masthead."

This picture represents the famous battle between the Constitution and the Guerrière on August 19, 1812. The Constitution also took the Java, December 29, 1812, the Cyane and the Levant on February 20, 1815. The vessel has never been broken up, but is now in Boston harbor. Years ago, when it was proposed to break her up, Oliver Wendell Holmes wrote the famous poem Old Ironsides, which prevented such action.

The first encounter on the seas took place when the American frigate Constitution, Captain Isaac Hull, met the English frigate Guerrière a hundred miles east of Boston. The meeting was welcome on both sides, for Captain Dacres had entered on the log of a merchantman a challenge to any American frigate to meet him in a ship duel. The Guerrière opened fire, but Captain Hull held back. He meant that every shot should tell. Crouching until the Guerrière was within pistol-shot, he sprang up and shouted, "Now, boys, pour it into them." The Constitution fired a whole broadside. The masts of the Guerrière fell; great holes were torn in her sides, and in less than thirty minutes from the time the firing began, she struck her flag to the Constitution. Not a spar was left standing, and her hull was so damaged that it was hard to keep her above water. Captain Hull could not even bring his prize into port, so he blew her up and returned to Boston with his prisoners.

No less brilliant was the victory of the United States, Captain Stephen Decatur, over the Macedonian. Decatur, in the United States, was sailing eastward in the neighborhood of the Azores, when he sighted a sail. The stranger made chase, and proved to be the English frigate Macedonian, Captain Carden. The enemy soon came abreast the United States, and action began. The fighting lasted one hour and a half, when the Macedonian struck her colors, almost a total wreck.

The same year the Constitution, Cap-

tain William Bainbridge, made another splendid capture. She fell in with the Java, a ship of the same tonnage as the Guerrière, just off the Brazilian coast. The Constitution waited until within pistol-shot of the enemy, when the command was given. In less than two hours the Java was fairly shot to pieces.

Captain Bainbridge was obliged to blow her up and land at San Salvador without his prize. The Constitution was ready for another fight two hours after the battle, and the Americans were so carried away with enthusiasm for this ship that they proudly called her Old Ironsides. Years afterward, when it was proposed to break up this ship, which was no longer of service, Oliver Wendell Holmes wrote that spirited poem, Old Ironsides, which you will find in the Book of Poetry.

The capture of the British sloop of war Peacock by the American boat Hornet, Master Commander James Lawrence, was much like the preceding victories in its results. The fire of the American was rapid and accurate. In eleven minutes from the time the firing began the Peacock was disabled and sank in spite of every effort to save her.

There had been a battle in the meantime between the sloops of war, the American Wasp and the British Frolic. The two vessels met off the North Carolina coast at a time when a heavy sea was running, which caused both to pitch and roll so that marksmanship had much to do with the outcome of the fight. Often the muzzles of the guns were under water. The enemy surrendered after forty-three minutes of terrible fighting. But Commander Jones lost the full satisfaction of his victory, for while the crew in the Wasp was repairing damages a British frigate came into view, recaptured what was left of the Frolic and took her and the Wasp to Bermuda.

WHAT THE ENGLISH THOUGHT OF AMERICAN SHIPS

Never had the English suffered such a series of defeats as the Americans inflicted upon their navy. Even the smaller vessels were victorious. The Enterprise took the Boxer. The Essex, Captain David Porter, sailed around Cape Horn and captured many merchantmen. One Englishman said that there was scarcely an American ship that could not boast a victory.

The first ship was lost when the frigate Chesapeake surrendered to the Shannon. The Chesapeake was at anchor in Boston harbor, where Captain James Lawrence was sent to fit her out for sea. When he arrived there he found that nearly all of her old crew had left the ship, and Captain Lawrence was forced to man the vessel with a crew of untrained, riotous men. While he was gathering them together Captain Broke of the Shannon sent a challenge to the Chesapeake asking for a ship duel in any place that the American captain named. He accepted the challenge and met the Shannon at sea. After a short, fierce fight the fire of the Shannon proved too much for the Chesapeake. She was terribly shattered, and Captain Lawrence was mortally wounded. His dying words were, "Don't give up the ship," but this surrender could not be prevented.

This loss was followed by others. The American ships were so few that before long they were either captured or blockaded in port, but the American navy had made a record that will never die. The naval war was now transferred to the lakes.

PERRY'S VICTORY ON LAKE ERIE

Meantime, as we may read in the Story of the United States, the war was being waged on land and on the Great Lakes. One decisive battle, won by young Perry, gave the Americans the command of Lake Erie, and this battle has stirred Americans as no other battle in our history has ever done.

The loss of Detroit soon after the war began was a great blow, for the British then came into possession of the whole Northwest Territory, and with it passed the control of Lake Erie. Now, Detroit without the command of the lake would have been of little use to the British, for at that time it was impossible to send sufficient supplies overland to the British soldiers stationed there. So if the Americans could get back the control of Lake Erie, the first step toward recapturing Detroit, and in the end the whole of the Northwest Territory, would have been taken.

THE YOUNG NAVAL OFFICER WHO WAS TO SECURE CONTROL OF THE LAKE

Things looked unfavorable for the Americans when Oliver Hazard Perry, a young naval officer, was sent to Presqu'

Isle, on Lake Erie, to take charge of a small squadron that was being built there. Perry, who had been in the navy from his fifteenth year, had served as a midshipman in the war with Tripoli. After the War of 1812 began he was for some time in command of a little fleet of gunboats on the Atlantic coast, and though he was only twenty-seven, he had already given proof that he was a skillful commander as well as a brave and daring man.

When he arrived at his new station he found the keels of two brigs laid and three gunboats well under way. The two brigs were the Lawrence, named after the unfortunate captain of the Chesapeake, and the Niagara. With a gang of ship carpenters young Perry set to work to finish building and to equip a little squadron in a place that was almost a wilderness. They cut down trees from the western shore of the lake and used the green timber for the vessels, while most of the material for equipping the ships had to be brought five hundred miles from the seaboard.

The British had been building ships, too, and their new ship the Detroit was nearly ready for service.

The quick work of the American seamen had aroused the alarm of the British. Captain Barclay, one of Nelson's veterans, in command of the British fleet, meant to have his squadron on the lake and keep the American ships blockaded near Presqu' Isle, but Perry was too quick for him. His ships were already on Lake Erie and he was on the lookout for the British.

A BATTLE NECESSARY FOR BOTH SIDES

The British squadron, finding Perry in full control of the lake, remained at Malden, on the Detroit River. Captain Barclay had great trouble to get a crew, and he was determined not to come into action until he had what he thought was the full equipment of seamen. But difficulties about the food supply were staring him in the face. He could no longer get food in his neighborhood, and the presence of the American squadron made it impossible for him to reach Long Point, the supply station, without coming into open fight.

In the meantime the American squadron had decided not to wait for the enemy, but to sail over to Malden and attack the British at that place. So Perry's fleet set sail for that purpose. At sunrise on September 10, 1813, the lookout at the masthead of the Lawrence sighted the British squadron in the northwest. Captain Barclay's seamen were hungry, and he had decided that he must open communications with Long Point even if it meant fight.

THE STRENGTH OF THE TWO FLEETS COMPARED

There was some difference in the strength of the two fleets. Perry had nine ships, while the British had six, but the latter carried more guns. The British vessels were larger, but their guns were smaller; and Captain Barclay had served under Nelson at Trafalgar, while the young American commander had to make up in spirit what he lacked in experience. But he had spirit enough for what was to follow. "To windward or leeward they shall fight to-day," was his command when the British hove in sight.

Perry, in his flagship the Lawrence, displaying a blue banner bearing the words "Don't Give up the Ship," advanced, but the British in line in close order awaited the attack. The Lawrence hailed. The British waited until she was within range and then made her a target for their fire. The fighting that followed was most desperate, and the Lawrence was soon almost a wreck. Perry fought her until nearly all of his men had fallen. It was a supreme moment—most men would have surrendered. He saw it would be madness to stay longer in his shattered ship. With eight men and his little twelve-year-old brother he jumped into a rowboat and, standing, blue flag in hand, made straight through a shower of shot and shell for the Niagara, another vessel of his fleet, which had not suffered much harm.

THE BATTLE RAGES AND THE OUTCOME IS DOUBTFUL

With renewed energy the battle then raged with greater violence than before. The few men left on the Lawrence were compelled to haul down their flag, but the British were too busy to take possession of her. Perry sailed into the very midst of the British fleet. He tore through their lines, pouring broadsides right and left. In fifteen minutes Captain Barclay was compelled to surrender, and Perry's great victory on Lake Erie was won. For the first time in history a dis-

patch bore the message that an entire English fleet had been captured. "We have met the enemy and they are ours—two ships, two brigs, one schooner and one sloop."

As a reward for his victory Perry was made a captain, was thanked by Congress, and was presented with a gold medal. He did not live long to enjoy his honors. At that time it was necessary to keep warships in West Indian waters to protect American ships against the pirates who infested them. Six years after his victory Perry was sent down with a squadron to perform this duty, and died there of yellow fever on his thirty-fourth birthday. A hundred years later great celebrations were held at different points along Lake Erie, and at Put-in-Bay a memorial was unveiled to the men who had fought so bravely and so well. Matthew C. Perry, who commanded the fleet which opened Japan to the world, was a younger brother of O. H. Perry.

In Lake Champlain was another American fleet of fourteen small vessels under Thomas Macdonough. This was attacked September 11, 1814, by a large British fleet under Captain Downie, but Macdonough's bravery and skill won the day. The British lost 200 men besides prisoners, while the American loss was only 112. Peace was soon declared with all honor of the war due to the navy. Except at New Orleans, no important victory had been won by the army.

The United States has now one of the largest and strongest navies in the world. One of the smallest ships of the present day with its armor and rifled guns could destroy the whole fleet of the War of 1812, but Americans will never forget the sailors and the ships of those times.

During the century and more since the close of the War of 1812 the American navy has always been ready to fight, even in the days when it was small and weak. During the Civil War, the Spanish War and the World War the navy bore itself well, but we cannot stop here to tell of Farragut, Porter, Dewey, Sampson, Schley and all the rest. Whether they serve upon battleships, destroyers or submarines, the American officers and sailors have always been ready to do their whole duty.

This painting shows the dramatic moment when Commodore Perry, leaving his shattered flagship the Lawrence was rowed to the Niagara to begin the battle with renewed energy. The flag was not the Stars and Stripes, however, but the blue banner on which were Lawrence's dying words, "Don't Give up the Ship."

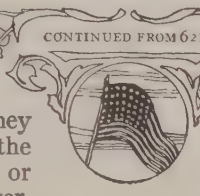
THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6397.

WHAT THIS STORY TELLS US

YOUR editors have admired Sir Walter Raleigh from their boyhood, and in other volumes of our book you will find much said about him. His most important claim to the admiration of American boys and girls has been hardly mentioned, however, and this story will tell you why Americans should respect his memory. He had the idea of building up a new England in America, and gave much of his money, and spent much of his time, to bring it about, only to fail in the end. The failure was not his fault but was a great grief to him. The story of the "Lost Colony of Roanoke" is one of the most romantic in American history, and we wonder about the fate of little Virginia Dare.

THE LOST COLONY OF ROANOKE

CONTINUED FROM 6219



THE first expeditions to the New World were not sent with the idea of permanent settlement. They spent their time looking for the passage to India and China, or else sought only gold and silver. Walter Raleigh and his half-brother Sir Humphrey Gilbert were among the first Englishmen who desired to set up "little pieces of England" in America. They started with seven small ships in 1578, but whether to explore America or to capture Spanish treasure-ships is not quite certain. At any rate, they had a fight with the Spaniards and returned without success. Sir Humphrey Gilbert was lost at sea returning from a voyage to Newfoundland in 1583, but Raleigh was not discouraged.

The next year Queen Elizabeth made him a knight and gave him permission to settle any "remote heathen and barbarous lands" still unoccupied by Europeans, giving the people who should settle there all the rights of Englishmen, including the right to make their own laws.

Raleigh soon sent out two little ships commanded by Philip Amadas and Arthur Barlowe. They touched Florida and sailed along the coast until they reached what is now North Carolina, on July 4, 1584. Following the coast, they came to a gap in the sand banks which fringe it and entered Pamlico Sound. They landed upon an island which to their eyes seemed a paradise. The stately pines, the cedars, and the abundance of grapes, which, they reported, grew down to the water's edge, so that "the very beating and surge of the sea overflowed them," filled them with wonder. Game and fish were also plentiful. The Indians called the island Roanoke, and it bears that name to the present day.

The Indians were friendly and brought them fish, and were much pleased with a few trifles given them. The explorers visited the Indian village and were charmed with all they saw. Two of the Indians agreed to go to England with them. The name of one was Manteo, and the little town on the island to-day bears his name. The whole country was named "Virginia," in honor of Queen Elizabeth, sometimes called the "Virgin Queen."

Sir Walter Raleigh was delighted with the report of his explorers, and early in 1585 sent out over a hundred men under Ralph Lane to found a colony. Unfortunately Sir Richard Grenville, who commanded the ships which took them over, quarreled with the Indians and set fire to their corn.

The little colony built a little fort as a centre for the "City of Raleigh," but seems to have spent more time in exploring and hunting gold than in planting crops. Some of them followed the broad Roanoke River, hoping to find a passage to China. One of the party was John White, who had some skill in drawing. He made pic-

tures in water colors of the Indians at work and at play and of their houses. Some of these were published at Frankfort, in Germany, in 1590, five years after they were made, to illustrate the story of the expedition written by Thomas Hariot, the famous mathematician. Both story and pictures tell us much of Indian customs before they were changed by the white men. The pictures themselves are in the British Museum in London. We show you here some photographs of the drawings.

This is one of John White's pictures, showing in the foreground two Indian hunters, and behind other hunters chasing the deer. You can easily distinguish the figures he drew from life and those for which he drew upon his imagination. The physical strength of these men seems to have impressed the artist very much, and he brings out their muscles very carefully.

As the Indians refused to sell their corn, the party began to suffer for want of food the next year, and the expected supplies did not come from England. Just at this time Sir Francis Drake, of whom you may read on page 4962, stopped on his way home from an expedition against the Spaniards. He agreed to take the hungry, homesick men back to England, as they asked.

A little while later Sir Richard Grenville arrived with the supplies which had been delayed, only to find the island uninhabited. He could not believe that all the men were dead and did not guess that they had gone back to England. He thought that they were somewhere on the mainland hunting gold or trying to get to China, and so he left abundant supplies, with a guard of fifteen men, and sailed back to England.

All England was then stirred up over the war with Spain, which all saw was coming, but Sir Walter Raleigh would not give up the idea of planting a colony. So in the next year, 1587, he sent out another colony, of about one hundred and fifty men, women and children, under the same John White who drew the pictures we show you here. Governor White was ordered to go to Roanoke Island, get the supplies and the fifteen men left there the year before, and then go farther north into Chesapeake Bay, where there were better harbors. The commander of the ships, however, was anxious to get back to Europe, and after a part of the men had gone to Roanoke Island in a small ship, he landed all the rest on the coast, and sailed away. So the third colony was forced to settle in the same place.

The party looked in vain for the fifteen men and the supplies, but found only a skeleton here and there. The Indians had killed the men and taken some of the

HOW THE SOUTHERN INDIANS COOKED

The methods of cooking among the Indians interested the first Europeans who came to America very much. The two pictures on this page show that the Indians on the North Carolina coast did not suffer for want of food. The earliest explorers tell us that all kinds of food were plentiful. Here we see the preparation of a sort of stew of fish, green corn and other things hard to recognize.

The waters of North Carolina to this day abound in fish of every description, and here is a method of cookery common among the Indians. Several varieties in the picture may be recognized by everyone who has studied fish. The report of Sir Walter Raleigh's first expedition says that an Indian caught all that the ships could use in a very short time. Several were entirely new to the Englishmen.

supplies and destroyed what they did not care for. Since the ship had sailed away, the colony had to remain, and all set to work to build new huts. In the party was the governor's daughter, Eleanor White, who was the wife of Ananias Dare, one of Governor White's assistants. To them was born, August 18, 1587, soon after they landed, a little daughter whom they named Virginia in honor of the country. This little girl, Virginia Dare, was

When he arrived in England the great Armada, with which Philip of Spain expected to conquer England, was almost ready, and every ship in England was being prepared to fight. Sir Walter Raleigh made two attempts to send aid to his little colony. Once the ships were seized for the government, and the second expedition, under Governor White, was driven back by Spanish ships. Then came the Armada, about which you may read

We are told that this picture represents a solemn festival dance among the Indians of what is now North Carolina, as seen by an Englishman more than 300 years ago. The savages, almost naked, danced round the circle of posts, striking them with their rattles as they passed. The one who could dance the longest and jump the highest was considered the winner.

the first child born of English parents in what is now the United States. The county in North Carolina of which Roanoke Island is a part is called Dare County in her honor.

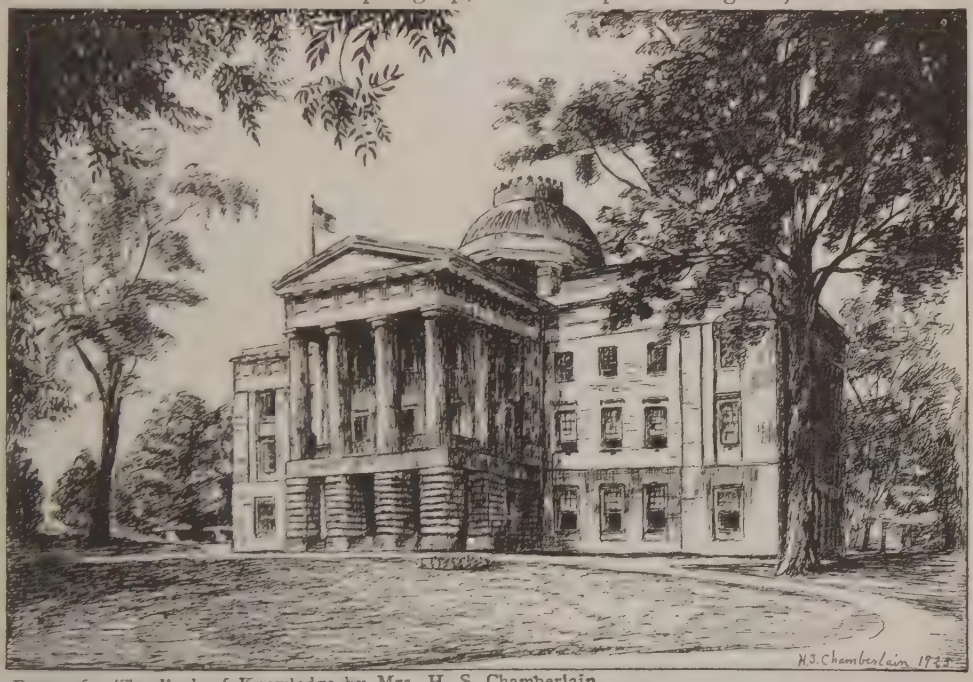
Since the Indians had not only killed the men, but had taken or destroyed the stores and supplies they were set to guard, the colony had great need of many things in order to live. Governor White therefore thought it necessary to take the one little ship left them and start back to England for help. His little granddaughter was then only about a week old.

on page 1820, and there were many months of fighting, in which Raleigh had a prominent part.

Finally poor Governor White, who must have been almost distracted, arranged with a sea-captain sailing to the West Indies to take him as a passenger and to stop at Roanoke Island on his return voyage. Finally, in August, 1590, when his little granddaughter would have been three years old, he reached Roanoke Island.

On the island there was not a sign of human life. The doors of the huts stood

open and grass grew in the fort. Chests and boxes which had been buried had been dug up. Some of Governor White's books and drawings had been scattered to the winds. There were no signs of a struggle, and the only clue was the word "Croatan" carved deep on a great tree. This was the Indian name of an island, now a peninsula, about fifty miles away. We are told that the ship proceeded toward that place, but one of those severe storms common on that coast sprang up,



Drawn for The Book of Knowledge by Mrs. H. S. Chamberlain.
Though Sir Walter Raleigh's attempts to found a colony in the New World failed, he was not forgotten. When North Carolina became a state it named the new town, built for the capital of the state, Raleigh, in his honor. This is the dignified capitol building in the centre of the town which reminds the people of the state of the great man who tried so faithfully to settle the country.

and after beating about for several days the captain, in spite of the prayers of the father and grandfather, set sail for England, leaving the colonists to their fate. Raleigh made two further efforts to find his colony, five in all, and after the failure of his last, in 1602, just before he was imprisoned, declared that he would yet see "an English nation in Virginia." He was sent to prison by James I in 1603 and was put to death in 1616. Before his death the colony of Jamestown had been founded by others, and that weak little colony managed to exist, in spite of many drawbacks.

The settlers at Jamestown, after their arrival in 1607, were told by the Indians that the colony of Roanoke had lived peacefully among the Indians for several years, adopting the Indian mode of life. Finally the medicine-man had stirred up the tribe to murder all except four men, two boys and a girl. Perhaps this story was true, perhaps not. If so, was this girl Virginia Dare? Mary Johnston, who has written several romances of colonial days in the South has a story called Croatan. In it she pictures the weary waiting for a ship from England, and tells what she imagines the life of Virginia Dare must have been after she grew up to be a woman.

To this day many believe that some of the colonists were adopted by the Indians and married with them. As proof they point to the gray eyes and red hair sometimes seen among the Croatan Indians who yet live in North Carolina. These Indians themselves say that they have been told by their grandfathers, who were told by their grandfathers, that their ancestors came over the sea and could "speak out of a book." All we really know is that the little colony disappeared and has never been found.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6425.

BUDAPEST AND OTHER CITIES IN HUNGARY

Central market, Budapest.

Basilica, Budapest.

Academy of sciences, Budapest.

The River Danube as it flows through Budapest, capital of Hungary.

The royal palace at Budapest.

Orsova on the Danube.

Raab, a town in Hungary.

A street in Stuhlweissenberg, in Hungary.

Serbian peasants herding swine.

THE STORIES OF HUNGARY, CZECHO-SLOVAKIA AND JUGO-SLAVIA

CONTINUED FROM 6198

THE Hungarians, a nomadic race of Asiatic origin, burst into Europe about the year 900 under a leader named Arpád. A nation of horsemen, brave and terrible in battle, they thrust themselves like a wedge between the Slav races in Bohemia and Serbia, and settled in the fertile plain of the middle course of the Danube.

About the year 1000 they were organized by a great elected king, Stephen, into a powerful nation. The arrangements he made for governing the country, under a number of chosen nobles, have left some traces to the present day.

The fame of Stephen and of a later king named Matthias left in Hungary a feeling in favor of kingship which has not yet disappeared. Hungary only accepted peaceable union with Austria by taking the Austrian emperor as her own king and regarding herself as a separate country. Even now the feeling remains, and when, from out of the ruin brought by the war a Hungarian republic was set up and a general election arranged, the first act of the new Hungarian parliament in 1920 was to elect, not a president but a regent, and to announce that, though she had no king, Hungary remained a monarchy, governed by a royal ministry.

A glance at a map of Hungary as it was before 1918 shows it as a country surrounded by mountains. From the Hungarian gate, near Pressburg, where the Danube enters the country through a defile between spurs of the Alps and Carpathians, mountains ring the land northward in a great semicircle. They spread out broadly in the east over the whole province of Transylvania, and meet the river again six hundred miles away, at the Iron Gates Rapids. There the waterway becomes the boundary between Serbia and Rumania. To the westward outlying ridges of the south-eastern and Dinaric Alps skirt the country, and cross western Croatia till they pass into the highlands of Bosnia and Serbia.

THE GREAT PLAIN WHERE THE MAGYARS MADE THEIR HOMES

The central part of this mountain circle is a great plain with the Danube passing through the middle of it. It receives from the Carpathians the tributary river Tisza and the Transylvanian Maros, and from the Alps the Drave and the Save. The foothills of the Carpathians extend a hundred miles to the plain.

It was in this plain that the Magyar race made its home, first as a nomadic cattle- and horse-rearing people, and then as settled agriculturists. Though by its warlike energy and central posi-

tion it has held the Slav peoples around as subject races, it has never been able to win their hearts or wean them from their own languages.

The Transylvanian hills were inhabited by a majority of Rumanians, and the lower, or southern, part of the plain by Rumanians and Serbs. The Carpathian slopes, to the very edge of the plain in the north, or beyond it, were peopled by Slovaks, allied in race to the Czechs of Moravia. In the south, between the Drave and the Save, in Slavonia and Croatia, the mass of the people were closely allied in race and speech to the Serbs.

THE BREAK-UP OF HUNGARY AND THE GROWTH OF SURROUNDING STATES

When the crash of the World War came, all these surrounding races, which had never been one in feeling with the Hungarians, broke away and joined the new countries that were forming, drawn together by the same race and language.

Thus, all the Transylvanian highlands and the eastern edge of the plain passed over to Rumania. The Carpathian highlands and the northern edge of the plain were inhabited by Slovaks. These eagerly joined with the Slav Czechs of Bohemia and Moravia, who had seceded from Austria and made up the new republic of Czecho-Slovakia. Another section of the people of the southern part of the plain joined Serbia to form what is now called Jugo-Slavia, along with the inhabitants of the two Hungarian provinces of Slavonia and Croatia, and the Austrian provinces of Carniola, Bosnia, Herzegovina and Dalmatia. See map on page 6197.

In this way an enormously large Rumania was formed on the eastern side of Hungary, an enormously enlarged Serbia on the south, and a new country of Czecho-Slovakia on the north. Hungary itself was left with less than half its population and much less than half its territory. Something like a million Magyars were included, as a small minority, in the fringes of the three countries that had reduced Hungary to a small, compact, almost entirely Magyar state.

THE LIBERTY THAT HUNGARY STROVE FOR BUT DENIED TO OTHERS

For this reduction of her territory Hungary was herself largely to blame. No people had struggled more bravely than the Hungarians for their own liberty in the past. But when they gained their independence from Austria and ranked in the empire as an equal state, they had not treated the Croats, Slovenes, Slovaks and Rumanians within their borders as they wished to be treated themselves. They had instead tried to suppress the languages and usages which the Slav races cherished. When the Hungarian kingdom, which had favored the war as likely to give it more power, found itself on the beaten side, the people fell into powerless disunion. The capital, Budapest, gave itself up to a brutal form of communism under Jewish dictators. The country people were nerveless and disorganized. Therefore the Rumanians occupied by force the lands which they thought were theirs by sympathy and race.

No country was treated more severely than Hungary after the war, because on every hand she lost districts in which considerable numbers of Hungarians lived, though they did not form a majority of the inhabitants. Outside the central plain the provinces taken from Hungary were hers only by annexation, and naturally joined their kinsmen in the adjacent lands. But the plain was Hungarian by long historical occupation, though its fringes had mixed populations. The drawing of the frontier line was specially difficult, as historical claims clashed with racial claims. Hungary, as the loser in the war, came off second best whenever these claims were balanced against each other.

The Rumanians said that when their country was overrun during the war, Hungary stripped them of much of their agricultural wealth in stock and machinery. In return they invaded Hungary and retook what they could find, and perhaps more. Hungary and Transylvania were lands where large estates were common. After the war Rumania, as part of her policy of national reorganization, divided all estates of a certain size (one hundred hectares) among the local peasant farmers, thus penalizing the Hungarian landowners. So there was not only national loss of territory but individual loss of land which was hard to bear.

The Hungarians, as a proud, conquering, and hitherto leading people, felt keenly the loss of territory associated with their early history. Thus Estergrom (or Gran), which was the capital of Hungary in the reign of Stephen I, and is still the ecclesiastical capital (or what Canterbury is to England), is now divided

THE HOMES OF THE HUNGARIAN PEOPLE

Hungarian women crushing maize in a simple type of hand-mill.

Maize hanging from a cottage roof.

Inside a mountain cottage.

Peasants inside the principal living-room of their cottage.

from Czecho-Slovakia only by the Danube; and Pressburg, which for centuries was the capital of the country, is now (under the name of Bratislava) the capital of Slovakia, a province of Czecho-Slovakia.

Hungary, however, is still left with the richest of its lands. It is a country with immense agricultural resources, connected closely with its fine capital, Budapest, the centre of its railway-system and of its great waterway of the Danube. Its ten million people may, by peaceful industry, do more than emperors and their wars to give it a prosperous position among the nations.

THE CZECHO-SLOVAKS AND THEIR COUNTRY

THE independence of Czecho-Slovakia was proclaimed on October 28, 1918, two weeks before the armistice was signed between Germany and the Allied powers that were against her in the World War.

The formation of this new republic showed how very strong are the bonds of race and common speech. A large majority of the people of Bohemia and Moravia (included previously in Austria), of Slovakia (included previously in Hungary), and of Upper Silesia (partly included in Austria and partly in Prussia) were of Slav origin. They spoke either the Czech language or dialects allied to it. With them went a small block of Ruthenians (of Russian race) who adjoined Slovakia south of the Carpathians, north of Transylvania and west of Bukovina. All these peoples swiftly made up their minds to unite and to revive the glorious memory of the old kingdom of Bohemia.

No movement of peoples following the war awakened more eager interest in other lands, for the Czechs had long been out of sympathy with Germans, Austrians and Hungarians alike. Their national feeling had been growing strongly through the nineteenth century in politics and literature. It had shown itself in the Austrian and Hungarian Parliaments and in books and education. Thus, in Prague, the capital of Bohemia, there were two universities, one Czech and the other Austro-German. The Czech University had twice as many students as the Austrian University, while the Czech higher technical schools outnumbered the scholars using the German language six times over. The higher schools of Brunn, the capital of Moravia, were similarly, but more equally, divided.

Historically, the Bohemian and Moravian Czechs had a right to be proud. Their mountain lands, walled in from the rest of the world but hemmed between Germany, Poland and Hungary, had been famous in thought, religion, education, public spirit, industry and bravery. They were ground between surrounding powers, particularly Poland and Hungary, when those countries were strong and ambitious. They were always being penetrated through their mountain frontiers by German influences. Yet, though again and again submerged under attacks from all sides, the Czechs rose imperishable, a people proud of their ancestors and wishful to play a part of their own in the world's affairs.

They remembered with honor the men of their race who had a European reputation—their Charles IV, son of the blind king whom the English killed at Crécy, who brought the country a new birth. Then there were George of Podebrad, their selected king, and brave John Huss, the successor of Wyclif and the cultivator of a love of religious freedom which has been cruelly suppressed but has never died out in Bohemia. John Komensky (or Comenius) was the first really popular educator who understood the needs of children. His influence underlies all the schools of Europe to-day. Comenius was a bishop of the Moravian Church who made the teaching of languages his favorite work. He adopted the system now used in small language manuals, with simple sentences in various languages saying the same thing. He also first used pictures as an aid to children's lessons. He broadened education by including history, geography and science. Much of his life was spent outside his own country, in England, Sweden and Holland, where his methods were appreciated. He died in 1671.

THE GREAT MINERAL WEALTH OF THE PROVINCES OF CZECHO-SLOVAKIA

The Czechs know, too, that their land, from an industrial point of view, is the most favored in Central Europe. Bohemia, Moravia, Silesia and Slovakia are rich in minerals. Coal is found in abun-

INTERESTING VIEWS IN CZECHO-SLOVAKIA

Pressburg, now officially known as Bratislava, in Czecho-Slovakia.

Charles bridge, Prague.

Cathedral of St. Vitus, Prague.

An old church, Prague.

A general view of Prague, capital of Czecho-Slovakia.

Herrnskretschen, Czecho-Slovakia.

The Hradcany, or capitol, of Prague.

dance in all the provinces, particularly in Silesia and Bohemia; iron in Bohemia, Slovakia and Moravia; gold and silver in Bohemia, Moravia and Slovakia; and rarer metals, such as copper, tin, antimony, cobalt, nickel and arsenic can be found. The manufactures include machinery, textiles, glass, chemicals and furniture; all forms of agriculture are engaged in and are very valuable. Beet-growing and sugar-refining are highly important; the fruit crop is large and fine; potatoes are largely grown; and forests are extensive.

By the formation of Czecho-Slovakia Austria and Hungary both lose their best mineral supplies.

A NATION OF FOURTEEN MILLIONS SETS OUT ON A NEW CAREER

To a considerable extent Czecho-Slovakia has strong natural boundaries. Bohemia is a table-land surrounded by mountain ranges. The highest part of the plateau is in the south, so that the rivers—the Elbe and its navigable tributary the Moldau, on which stands Prague—run northward, breaking through the mountain ring. Moravia is a similar plateau, but tilted southward, so that its chief river, the Morava, from which the country is named, empties into the Danube. Its lower course now separates Lower Austria from Slovakia. Silesia is beyond the northern mountains of Moravia, but on their slopes descending toward the river Oder, without reaching its plain. Slovakia is edged to the north by the Carpathians, but descends into the plain.

Czecho-Slovakia began its new career as a nation with nearly fourteen million inhabitants. Of these its magnificent historic capital, Prague, has 670,000, and Brunn 200,000. Other large towns are Pilsen in Bohemia, Pressburg, the capital of Slovakia, and Olmutz, a manufacturing centre in Moravia.

The Czecho-Slovakian Republic elected for its first president, for seven years, Professor Masaryk of the Czech University of Prague, the man who, more than any other, had aroused, stimulated and guided the Czech national feeling.

Of the new nations formed at the end of the World War the most successful and prosperous during the following five years was the Czecho-Slovakian Republic. It quickly won the good-will and admiration of Europe. Though its population was mixed—Czech, Slovak, German, Magyar and Ruthenian—it went on steadily with peaceful improvement. It organized a democratic but steady government, put its finances in good order under great difficulties, and increased its industries with astonishing rapidity.

THE LEADER OF THE NEW NATIONS IN EASTERN EUROPE

This was due to able and trusted leadership, to the great national wealth of the country, and to the high standard of skill, intelligence and willing help of all its people. Prague became a capital toward which Europe looked with confidence.

President Masaryk, Dr. Benes and the foreign minister ranked at once as European statesmen. Dr. Rasin, the minister of finance, though less known abroad, was equally masterly in his department. These were the capable men who formed the republic, and they were trusted as they deserved to be. No other nation produced such wise leaders, able to concentrate national energy on sound recovery from the effects of war.

Czecho-Slovakia became the leader of the new nations of Eastern Europe, which required time to strengthen themselves against possible interference by the Soviet Government of Russia. Dr. Benes was the first to plan that Poland, Rumania and Jugo-Slavia should unite with Czecho-Slovakia against any unprovoked attack that might occur. This is known as the Little Entente.

In many ways the country gave evidence of being enlightened and practical, and no part of the Slav race has shown such a union of hopeful qualities as the Czechs.

THE JUGO-SLAVS AND THEIR HOMELAND

ONE of the effects of the World War was the complete upsetting of the group of nations known as the Balkan States.

Those nations had been Serbia, Bulgaria, Turkey, Greece, Albania and Montenegro, with Rumania disowning association with the rest and Austria a powerful intruder. But now great changes have been made. Turkey has been limited to eastern Thrace. Rumania has extended northward till she becomes a power of Middle Europe. Serbia, incorporated in a new nation, also reaches

RURAL COSTUMES OF OLD AUSTRIA-HUNGARY

Jugo-Slavs.

Czecho-Slovakian peasant.

A Hungarian family.

Austrian peasant.

Workgirls of Vienna in Bohemian costume.

Old Austrian.

Montenegrin peasants.

A Bohemian apple woman.

Hungarian gooseherds.

A Jugo-Slav farmer.

Czecho-Slovakian peasant.

Photos, Messrs. Cutler, E.N.A., McLeish, York & Son and others.

Central Europe, and has a population of about twelve millions.

The states forming the United Kingdom of Jugo-Slavia, to distinguish it from the kindred nation Czecho-Slovakia, are Serbia, Montenegro, Herzegovina, Bosnia, Dalmatia, Slavonia, Croatia, Carniola and a part of the Istrian peninsula.

Here we have a country six hundred miles long by three hundred at its greatest breadth, inhabited by people who, though separated from each other by mountain barriers, are drawn together by four main facts.

First, though races and religions are mixed, a large majority of the people are of the same stock, and long ago were driven into these hilly lands by invasions of Huns and Bulgars who were not near akin to them. Secondly, they all retain the same foundation for their language, though separation among the hills has brought them several strong dialects. Thirdly, Serbs and Croats and Bosnians, Slovenes and Dalmatians, had all alike suffered under the sad experience of being governed against their will, all of them by Turks, some by Magyars, and others by Austrians.

Again, the lives of all the Slav people between the Danube and the Adriatic were very similar. All lived by agriculture in forest lands with valuable minerals in the hills, remote from the manufacturing world—coal, iron, copper and even quicksilver in Slavonia. But each state was hampered by dreary mountains fencing it off from the Adriatic Sea, with Italy on the other side of the sea jealously keeping watch on the best outlets for traffic.

Serbia was the natural rallying-centre for these Slav races, for Serbia had already won liberty and gained by her defense of it the admiration of the world.

And so Serbia, sloping northward from the Balkan Mountains by her river Morava, sends her produce by Belgrade, her capital, to the Danube. And, sloping southward by the river Vardar, she trades through Greece to Salonica at the head of the Ægean Sea.

Bosnia reaches the sea more directly; for its capital, Sarajevo, sends through the mountains, past Mostar, the chief town of Herzegovina, a railway to Gravosa on the Adriatic. This is the harbor of the ancient port of Ragusa.

Zara, the capital of Dalmatia, is an Italian-looking town. The principal port, Spalato, has an advantage, which Zara has not, of railways leading into the interior to Sarajevo, and on to Esseg, the capital of Slavonia, and Zagreb, the capital of Croatia. Zagreb, the principal town in this part of the new country, reaches the sea by rail both at Fiume and Trieste, and connects up with Belgrade through the valley of the river Save.

Each state in Jugo-Slavia, except Dalmatia and Montenegro, is largely forest land, with swine, sheep and goats as the most numerous animals. Maize is the most used of cereals; tobacco is grown here and there; potatoes are much used as food in the lower lands. Fruit is an important product, especially plums. The only flat regions, except the part of the Hungarian plain around the Danube and the Tisza, are the central part of Croatia, which is much-flooded fenland, and the eastern part of Slavonia, a fertile corn-growing tract.

The gem of the whole country is the Alpine pasture land above the town of Zagreb, leading into Carniola. Dalmatia is bare and mountainous, and its people are largely engaged in transit work connecting the inland states with the Adriatic coast. Bosnia, which was under Turkish government for four hundred years, is curiously mixed in religion, for, although the people are nearly all Slav by race, about a third of them are Mohammedan in faith. So, indeed, are many of the inhabitants of what was formerly called Macedonia. They have now been absorbed into Serbia, but the instincts of race, freedom and language have had an overpowering effect in producing national unity. This influence is seen in the uniting to the Serbian state of the little mountain kingdom of Montenegro, which has always prided itself on its independence, but has now at last become merged in the larger state.

Montenegro had been governed, in a patriarchal way, by its king, Nicholas, for fifty-eight years when, in 1918, by the will of his people he was deposed, that they might complete the union of the Southern Slav race. He died out of his country in 1921, a sad old man. The chief town of Montenegro is Cettinje. Antivari and Dulcigno are its ports. The population of the province is about half a million.

Jugo-Slavia has the usual difficulty of

PICTURESQUE VIEWS IN JUGO-SLAVIA

Ragusa, a seaport of Jugo-Slavia.

A street scene in Sarajevo, Jugo-Slavia.

The National Theatre at Zagreb.

A general view of Uskub, in Jugo-Slavia.

the countries of Eastern Europe—a variety of races, sometimes closely intermixed, with some differences of language and customs in the main race. The Serbs, Croats, Slovenes, Bosnians and Montenegrins are all Slavs. They differ according to locality. The country's chief problems are: first, to provide a strong central government, as well as freedom in local government; and, second, access to the Adriatic Sea for trading purposes.

Italy, as a country out in the open world with a sea trade for two thousand years, has long associations with the eastern seaboard of the Adriatic. The trade of its ports is largely carried on by Italians. She may be said to be leader there since she annexed Trieste and Austria became an entirely inland country. Before the war Fiume was an outlet port for Hungary, as that country held the inland provinces behind Fiume. Now these provinces are part of Jugo-Slavia. The trading port of Fiume has a majority of Italian inhabitants, but its inland suburb Shushak, which also reaches the sea, is inhabited by Slavs, and the whole region is territorially in Jugo-Slavia. But its people are not a seagoing people. Historical feeling and maritime trade are regarded by Italy as giving her a right to own the port. Jugo-Slavia, on the other hand, regards Fiume as a natural outlet for her products.

For a while, under the Treaty of Rapallo, Fiume was a free city, and Shushak belonged to Jugo-Slavia. But this was not practical: trade withered and the harbor was deserted. The port cannot be of service unless it is used as a gateway for the Danube basin, importing Italy's manufactured goods and exporting Jugo-Slavia's food and raw materials. So, in March, 1924, Fiume was formally taken over by Italy, in accordance with a treaty signed in January.

THE MOUNTAIN STATE OF ALBANIA

ALBANIA began to exist as a separate acknowledged nation in 1912.

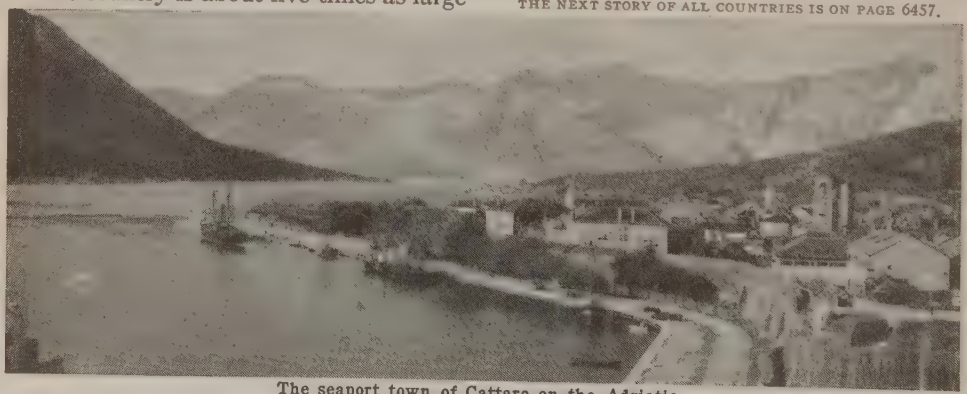
It is a mountainous land bordering the Adriatic Sea to the northward of Greece and southward of the Dalmatian part of Jugo-Slavia. As a region where two-thirds of the people are Moslems, the country was closely linked with Turkey, and many Albanians formed a prominent part of the Turkish army in the old days.

The Albanians are a brave and warlike race, living in clans under local chieftains in the midst of their barren and inaccessible mountains. No great nation has wanted their bare and unorganized land, with its bold people, who have no system of law beyond what their religion ordains.

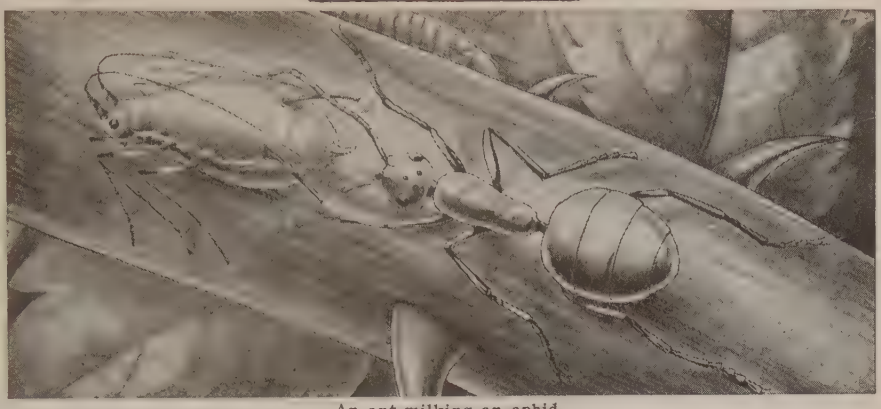
The country is about five times as large as Prince Edward Island, and has an estimated population of about a million. The people are divided by some differences of race, language and religion into two groups: the Ghegs in the north, and the Tosks in the south; but they are sufficiently united to be admitted to membership in the League of Nations. They are governed in local combinations by what are called regents, who are chosen by various religious groups.

Roads are the great need of the country. Cattle-rearing is the chief occupation. Tobacco is grown. Tirana (12,000), Scutari (32,000) and Elbasan (13,000) are the largest towns. The chief ports are Durazzo (5,000) and Valona (6,000).

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6457.



The seaport town of Cattaro on the Adriatic.



An ant milking an aphid.

THE WONDERFUL ANT

CONTINUED FROM 6233

Wood Ant.

THE ants have a certificate from Solomon for diligence and wisdom. They are perhaps the most impressive little creatures in the entire animal kingdom. Their social system is even higher than that of the beehive and in many ways startlingly resembles that of mankind.

Some of the things ants do outdistance the skill and instinctive habits of many tribes of men known to science. These insects have a knowledge of hygiene, of the art of taming other creatures and employing them for service, which is much ahead of that of untaught savages.

Some savages have no civic life, no homes, no animals, no crops. The ant is a citizen of a considerable city marvelously planned, with ordered streets and highways. It has nurseries for its young ones, storehouses for its food, quarters for its army and workers, cattle abounding in stables which are in reality strong places of confinement.

The ants know so much of the art of living together in multitudes that with a little care and patience an informed author might write a story of their life in peace and war which might pass for a description of life in a human community. They have many virtues comparable to those of human beings, but they have vices as pronounced as ours, and of the same kind. The attitude of the ant toward nearly all animal life but their own and that of the creatures which they take as slaves or guests into their nests, is one of intense hostility—if hostility is the correct term. Perhaps we had better say that they have an appetite for anything that lives, and that in gratification of that appetite they are merciless, and eat while the victim is alive and in agony from their bites.

There are more than 3,500 distinct species of ants. They live everywhere on the earth except on the highest mountains and in the regions of perpetual snow. Most of them live in the earth, though some species live in dead or decaying wood, and others build nests in trees. There is no kind of food which some ant will not eat.

Courage is the badge of all the race. It is hard to believe that they swarm to attack huge pythons which crush cattle, but it is true. The snake has no terror for enemies whose numbers are overwhelming even after thousands may have been crushed by the writhing giant. The ants win in the end and devour the great reptile. A snake is so huge and so formidable that they may slaughter it in ignorance of the wonder they perform.

A timid man in ambush may slay

an elephant or a tiger, yet flee from the uplifted fist of a puny member of his own race and sex. How, then, does the ant fare against an antagonist whose powers it may reasonably be expected to appreciate? There is no better answer than personal experience furnishes.

First, then, picture a swarming of brown garden ants. It was the day on which the young queens and drones were due to take their wedding flight—the most important day of the ant year. A series of ant cities were kept under observation by the writer. The nests were at intervals of from six feet to sixty yards and more apart. All were separate, distinct, and without any communication with each other.

THE WORKER ANTS THAT RISE EARLY IN THE MORNING

Yet all swarmed on the same date, late in the autumn, a hot day, after a cold summer. The wingless workers were out in streams early in the day, but the winged queens and drones did not begin to appear till noon had passed. The workers assisted them out of the holes in a stuccoed wall which formed the exits from the city.

Timid and unwilling, the winged queens needed repeated support and encouragement to induce them to climb up the wooden posts of the fence from which they were to take flight. They were like nervous girl-brides leaving home, and demanded the sympathy and aid of their wingless relatives. They were petted and stroked; their wings were smoothed by the jaws of their attendants, and toward the close of the exodus it seemed as if the workers grew a little fretful and gave more than one shrinking queen a nip to make her mount into the air.

Now, at the summit of one of the posts which was serving as a sort of springboard for the queens there lurked a large wolf spider. It seemed to avoid the crowded area where workers and queens were congregated. But presently one queen, unwilling to try to fly, wandered away from the general assembly, as if to find another point from which to start.

THE REVENGE OF THE ANTS ON A RAIDING SPIDER

With one spring the spider was on her, but before he could fasten his fangs in her, a worker ant one-sixth his size dashed at him. The spider retreated in alarm, followed by his little assailant. Other ants at once joined in the attack, and, like a man springing from a precipice to avoid foes on land, the spider leaped into the air, and dropped five feet to the ground, paying out a life-line of silk as it fell.

It alighted among an army of ants on the pavement. Quicker than one can tell it, the ugly creature was swarmed on by the ants on the pavement. The spider seemed to recognize the hopelessness of the fight. After one attempt to run away it crouched down as if dead. That served no useful purpose, but hastened its end. The ants rushed on it like Furies. They bit it, they turned it over on its back, and in a trice they were hauling it to their hole. It was too big to be dragged into so small an opening; its sprawling legs lay like hurdles across the portal. The ants bit off its legs, and carried the fat body in!

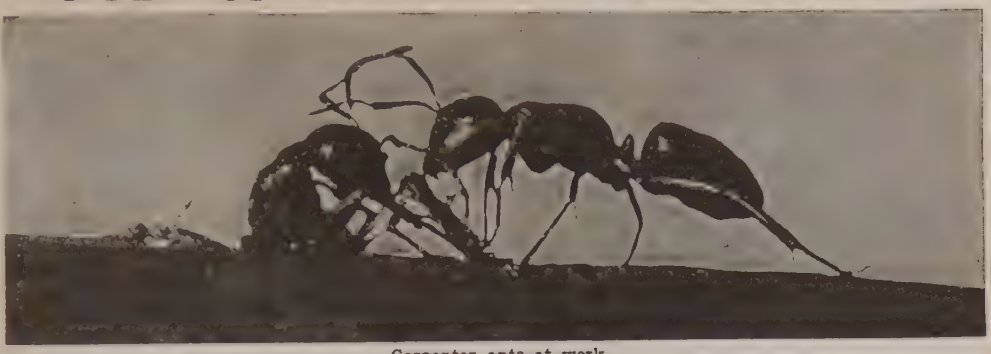
Picture the home of the ant—a labyrinth of highways, with halls and chambers, supported by pillars. There are nurseries for the babies, but as these are constantly hatching, they are of various ages. Therefore they are grouped according to the stage of development they have reached.

THE LOVING CARE WITH WHICH ANTS TEND THEIR YOUNG

How old this wondrous city is, how old the citizens, cannot be guessed. Some queen ants live, it is known, for fifteen years at least. The worker ants, too, may live for years. In this they have a great advantage over worker wasps and bees. The activity in the city never ends. The adult ants do for their little ones what the State might do for human children: watch over them from birth, assist them through youth to maturity, and bury them when they are dead. The one respect in which the ant fails is that it does not look after the sick.

They do look after the young. The care of the workers for the offspring of their queen is unexcelled in any grade of life. It is perhaps unnecessary to say that the queen is the mother of almost the entire population of the colony. She appears to have the power to regulate the sex of her children. That is to say, she produces at the fitting season eggs which will develop into workers, which we call sexless, and later she produces future queens and drones.

A FEW OF NATURE'S LITTLE WORKERS



Carpenter ants at work.

Tailor, or spinning, ant worker.

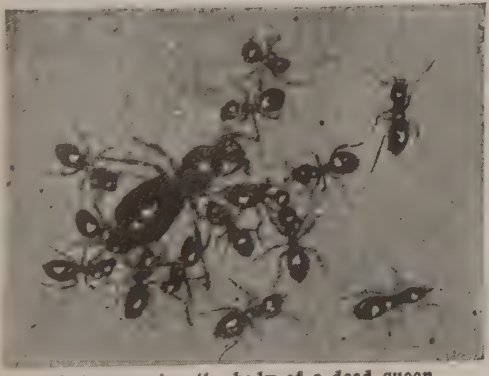
A winged female spinning ant.

Queen wood-ant.

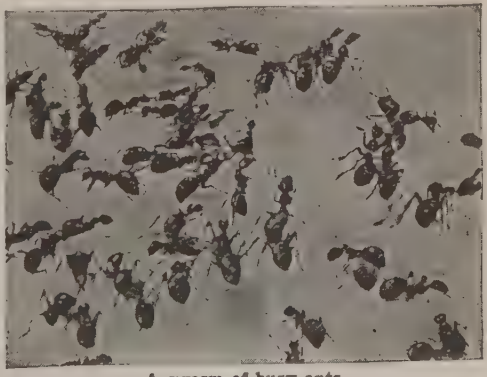
Driver ant worker.

Red wood-ant worker.

House-ant queen.



Ants removing the body of a dead queen.



A swarm of busy ants.

Practically all the citizens are her children, yet not quite all. The so-called sexless workers have the power, in time of need, to lay eggs, but, so far as has been discovered, these eggs always turn into male ants, the drones. When food supplies are scanty the queen ant, like the queen bee in similar circumstances, is likely to produce more male eggs. Generally she first lays the worker eggs, then the queen eggs, and finally the drone eggs.

This order is necessary, for the more workers, the greater is the supply of food brought in and the larger the staff of little workpeople to carry on the labors of the ant community. Let us imagine the summer hatching season in progress. The egg becomes a grub—legless, wingless, helpless. It is affectionately fed by the workers, who pre-digest the food for it in the same way as the bees do for bee larvæ. In turn the workers seem to like a fatty substance which comes through the skin of the larvæ, and eagerly lick it off.

Not only are the grubs fed and cleansed: they are carried about the city daily for airing and exercise. The period occupied by the grub stage is variable, but probably in no case more than two or three weeks.

THE SILKEN JACKET THE ANT GRUB MAKES FOR ITSELF

At the end of that time the ant grub of certain species spins itself a vestment of silk—a cocoon in which it lies foodless and inert while undergoing the change from a writhing maggot into a perfect ant. Three weeks is about the average term for this transformation. Throughout that time the workers tend the sleeping creature with all the loving care which they displayed to the ravenous grub.

Daily it is visited by its careful attendants. It is even carried up to an outlet of the city and screened by some sheltering stone. There it may derive the advantage of sunlight without the danger of observation. It is strange that these little people of the dark underworld realize more than we do the importance of sunlight to growing life.

At last the slow wonder is achieved, and a little ant is ready to issue from the silken shirt which the grub wove. But it cannot do so unassisted. The workers must aid in the removal of the imprisoning robe. It is a full-sized ant that creeps from the cradle bondage, for all development as to size takes place in the hungry grub period. But the new ant is not yet fit to hold its own with its enemies in the outside world.

It must still be fed and nurtured by its elders; it must be taught its duties in the nest, like a new boy learning the regulations at school. For two or three weeks this probation may last, in which time the new ant is housemaid, scavenger, builder, nurse, all things by turn. Finally it joins the hunters and goes out into the world to battle and capture food.

THE FEEBLE DRONES WHICH LEAVE THE NEST, NEVER TO RETURN

With the drones and queens the process is different. The queens do no work except egg-laying after workers are born. The drones are rather feeble folk, and cannot entirely feed themselves. On swarming day out they go to meet queens from other colonies. They never return. They are destroyed by birds or by other insects; winds and rains sweep them in multitudes to destruction, or they fall wearied at night to perish.

The queens, however, return to earth and either enter an old city where they live peacefully with the reigning queen, or else they start a colony of their own. Whichever the course, they have that one flight and that alone, for the first thing they do, on regaining the nest, is to break off their wings. Should a returning queen fail to do this, the workers break her wings off for her. There is no second flight for a queen, unless it be on foot to change her nest with all her children about her.

Such an occasion is deeply interesting to watch, for we are able then to realize what a value the ants set on child life. Next to the queen herself, if indeed second at all, they rank the eggs and babies foremost in significance. No wandering tribe of men and women marching across a continent ever showed more devotion to their children than these puny insects show for their eggs and infants.

THE ARMY OF FOLLOWERS IN THE TRACK OF THE MIGRATING ANTS

Such a migration is marked by an unexpected sight. The colony has a host of camp-followers—various insects which are the living treasures of the owners of the city. There are many beetles, there are lesser breeds of ants, there are multitudes of aphids.

These camp-followers go where the ants go. The willing ones are either parasites or pets. More than five hundred species of insects are known to inhabit ant nests. Some of them are kept because they diffuse odors pleasant to the senses of the ants. Some yield sugary secretions; some are unmistakably pets, things the ants rejoice to keep, feed and guard, just as boys love to keep rabbits, birds and caterpillars.

But the greatest wonder investigated up to now is in relation to the aphids. What do plant-lice, creatures of the foliage and the open air, down in the gloomy recesses of an ant city? They are the cattle of the ants, the milch cows. As we all know to our cost, the plant-lice emit a sticky solution, which we call honeydew. This is so plentiful when the plant-lice are well fed that not only does it impart a glutinous sheen to the leaves of trees, but actually drips to the ground.

That honeydew is the dearest food treasure of the ants, and to get it they practice arts which we could not believe, had observation not been a hundred times confirmed. The ants take the aphids prisoners, carry them down into their cities, and there pasture them out on the roots of some plant, such as grass. Some kinds of ants build a sort of shed over aphids on branches of trees. However, most species do not go to so much trouble, but merely "milk" the aphids where they find them, if at all.

How the ant city makes sure of its cattle supply

The aphid makes its return in the form of honeydew, which it surrenders to the ant at a touch of the latter's antennæ. We may see this done in the open, where an ant approaches a plant-louse on a roseleaf and there gently milks it, as it were.

But the plant-lice, though prolific, are short-lived. How is the supply to be maintained? In the autumn certain ants collect the eggs of aphids laid on plants in the open, carry them down into their subterranean nurseries, keep them there all winter, and when they hatch out in the following spring, transfer the baby aphids to the air and restore them to the food plant on which they will grow to strength and sufficiency of honeydew.

That happens in abundant instances in the North, so we are prepared to find ants in warmer lands extending the same type of prevision to the products of the field. The agricultural ants of Southern Europe, and of various places in the New World and elsewhere, garner grain for future use with superb skill.

The underground barns where food is stored for the winter

They have been credited with too much talent. They have been said to set the seed and reap the harvest. What they actually do is to bite down, in the vicinity of their cities, all vegetable growth save the grass known as ant rice, which forms a large part of their food. This gives unchecked opportunity to the ants' cereal. When it ripens they carry the seed down into their barns and store it against the coming of winter.

Buried grain germinates with heat and moisture, but not where an agricultural ant buries it. With supreme wisdom the little husbandmen bite off the radicle, the life-germ of the grain, so that it cannot grow. But it is found that when they desire sugar they allow a certain proportion of their booty to begin growing. Then they eat the transformed product, while still maintaining an ample reserve of the dry sterilized grain.

A new vista of perplexity opens here—the relations of ants to the plant world. Eager as they are for flesh food, the majority of ants dote on honey in all its forms, and this craving makes them robbers where they contribute no valuable return. Smooth-bodied and hairless, they are not pollen-carriers, as are the bees, so plants arm against them. The subject belongs more to botany than to the animal world, but the student of the ant must devote attention to it in the proper quarter.

The fierce armies that protect an acacia tree of America

We must, however, include here one amazing instance of mutual accommodation between trees and ants. The tree is a certain South American acacia, notably thorny and forbidding of aspect, yet generous of leaf, irresistibly alluring to hungering herb-eaters.

Now, each of those threatening thorns on the acacia is simply the outward defense of what is a fortress within, garrisoned by ants! The thorns are hollow and are inhabited exclusively by a specially virulent species of ants, which, when the tree is menaced by man or animal, dash out, swarm on him or it,

and bite and inject poison as if they loved their task and their tree.

How does the tree lure the ants to itself? The homes it affords are well enough, but if the ants had to roam in search of food the defense would be intermittent, and disaster might befall while the guardians sought their daily bread abroad. So the food is grown at home.

Each leaf of the acacia exudes honey in a generous stream, so that the garrison is furnished with meat, drink and abode all on the same tree, and on the same terms as those on which the old man-made cities of Europe and the feudal castles and estates of medieval times had their constant armed defenses. Flowers spread their charms for the delight of bees, but this extraordinary tree is modified entirely for the reception, housing, victualing, of nothing but ants, and entertains its armed retainers in myriads.

THE RETURN OF THE RAIDERS UNDER THEIR PARASOLS

One of the functions of these acacia-haunting ants seems to be to keep off marauding ants of another species, the famous sauba or parasol ants, as they are called. Their second name is derived from their habit of cutting out sections of leaves and carrying them upright, like umbrellas, over their heads back to their own nests. In the wilds their practice is harmless, for though they strip a tree, recovery is easy in that generous climate. The danger arises when men advance into the ants' territory and there seek to grow coffee, oranges and other products of civilized life.

Here these leaf-cutters are a destructive terror to the grower. He has no ants like those possessed by the acacia tree. So he denounces the parasol ants, but the naturalist admires and marvels. There is reason to do both. The saubas are well organized. Included in their ranks are not merely ordinary workers, but huge-headed soldier ants with terrific biting jaws.

When a leaf-cutting foray is coming, the soldiers marshal the workers into ranks and guard the flanks, where they attack and devour any enemy they may meet. In the same order the procession moves home with the booty. Enormous nests are made and stored with the leaves brought in—cities nearly forty feet in diameter and spreading out below ground.

Here are stored the stolen leaves. After treatment by the ants, the vegetation throws up a mass of fungus, which forms the food of the ants. Some naturalists believe that the ants cultivate the fungus. We do not know. It is certain that the fungus grows after the ants have gnawed it; we have no proof that it grows without such treatment.

THE DIVISION OF LABOR PRACTICED BY THE SAUBA ANTS

There is a scientific division of labor among the saubas, in the open as in the depths of the city. Multitudes scale the trees and drop the severed leaves to the ground, where waiting workers pick them up. This difference of tasks seems general among the hundreds upon hundreds of species of ants whose ways have been studied. Some of them have a perfect method of using effort for the common good.

We see them transporting grains of corn. Three or four ants to a grain carry prodigious burdens in proportion to the size of the bearers for half a mile and more. Others carry worms in the same way. It takes three ants to support and move the particular worm they favor. To do the work the three line up one behind another. Each straddles the worm and grips it with its jaws. Then they march. Under a good magnifying glass the bearers and their burden resemble very much the great vehicles which we employ for carrying tree-trunks.

THE LIVING STOREHOUSE IN WHICH THE ANT KEEPS ITS FOOD

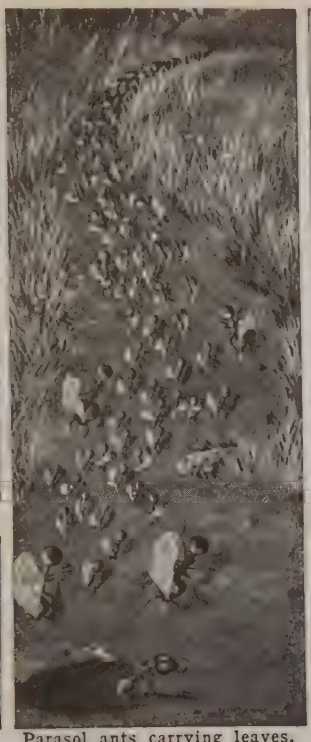
Nature has played her part in enlarging the ability of the ants to divide labor. Nothing stranger in the world is to be found in this direction than the honey-pot ants. This is a Mexican species in which certain of the workers remain always in the city and act as animate honeycombs. The workers bring in their nectar and calmly pump it down the throats of the honey-pot receivers. The sweet fluid passes down the gullet of the receiver and into the strangest of all stomachs. It is like a tough little balloon in which all the natural digestive organs are present, but ridiculously reduced, simply to permit of an enormous extension of the crop for the storage of the honey.

The ancients imagined a Tantalus whose fate it was ever to have luscious food and pleasant drink brought almost

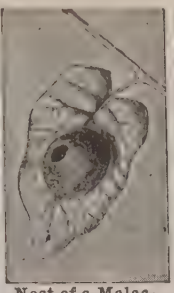
AT HOME WITH THE ANTS

Ant hill section.

Nest of an Australian ant.

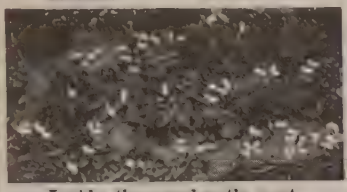


Parasol ants carrying leaves.



Nest of a Malaccan ant.

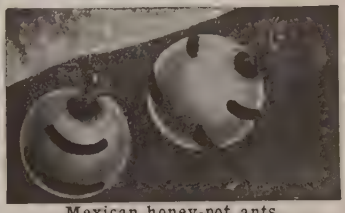
Tailor ant's nest.



Inside the wood-ant's rest.

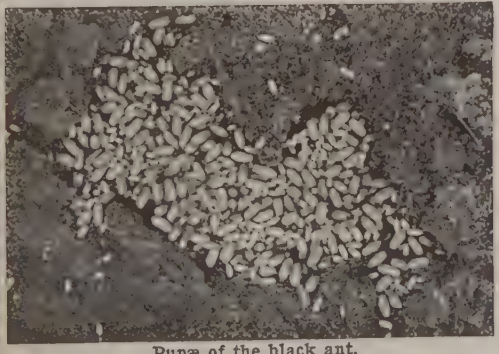
Nest of the wood-ant.

A stable of ants' pets.



Mexican honey-pot ants.

Meadow-ants at home in their nest.



Pupæ of the black ant.

Ants carrying cocoons.

The pictures on these pages are by Messrs. Collins, Paul Griswold Howes and others.

to his lips but never quite within reach. The ant Tantalus is filled to bursting with the spoil of innumerable flowers, but is not permitted to enjoy more than the barest amount of sweetness; it must receive at command and give back at a summons. The ants give, the ants take away, when they need honey.

That is the most curious adaptation we shall find; but there are others in the line we have considered, of blended forms and endeavor in the ant tribes such as Solomon never knew. Some species have engineers which, when the workers move out, construct tunnels for them so that they make great marches in search of prey, as well protected from observation as the trains in our subways.

The fierce attack of a host of blind raiders

Others, of the aphid-loving kind, run tunnels up the trees in which the honey-yielding cattle live, and bring them down into the citadel by these routes, or coolly wall in the aphids where they are and keep the tunnels for their own lines of communication.

Terrible to all other life in the vicinity are the operations of the larger and fiercer ants. The Eciton ants are notorious for the extreme severity of their attacks on all other living creatures within their range of action. They clear their line of march of every living thing as if a flame had swept it. Birds and beasts, every type of insect, are attacked and eaten piecemeal. Even creatures which feed on ants are overwhelmed by sheer weight of numbers.

Human habitations are not proof against them. The ants swarm through them, clearing every particle of food, every rat and mouse, every spider and fly, all the vermin which negligent natives tolerate in their homes. They are common in tropical Africa and South America.

The curious thing is that these ants are blind. They had sight once upon a time, but their habits of dependence on touch and smell have led to complete loss of the sense of vision. In spite of this they are quite efficient. Perhaps our northern ants, which obviously rely little on sight, will in time lose their power of eye, too. Already their ocelli, the three little eyes which they carry in addition to the two great many-faceted eyes, have practically lost their power of seeing through lack of use.

The terrible armament of the slave-raiding ants

That is not the only loss that ants sustain. As we have already said, the social life of these insects resembles human civilization in its worst vices as in the highest of its virtues. It is but a short step from the domestication and imprisonment of plant-lice and other insects to a regular system of enslavement. Many species of ants are confirmed slave-raiders, the redoubtable Amazon ants especially. They are formidably armed with great biting jaws, and their habit is to send out scouts to adjoining colonies of ants of lesser force. Then, at a given signal, they sally forth, thousands strong, to steal flesh and blood at whatever cost.

Added to their fighting qualities are impressive military abilities. They attack the doomed nest with a run and carry it by main force; or they surround it, place guards at every exit, then throw in what we must believe to be parties of picked fighters. Out come the rightful owners and battle is joined. The defense is hopeless. Soon the ground is littered with a horrible wreckage of ants bitten in two or torn to pieces. But while the fighters are thus wrestling in a death-grapple the raiders within are at the nurseries.

The lazy life which follows a successful raid

Out they come, each one bearing an egg or a larva. When the home has been denuded of its infant life, the column is re-formed and the living booty is carried back to the Amazon city. To what end? Simply that the larvæ, waking to adult life in a hostile land, may know no other condition, but meekly accept bondage. They become the slaves of their captors.

There never was a condition in life which slavery did not undermine. Greece and Rome became weak through their dependence on slave labor and slave soldiers. The ancient empires of the East rose and fell in tides as slaves were many and faithful or few and unstable. Most of the dynastic tragedies in modern Oriental lands have sprung from the plots of slaves in the seclusion of the royal palaces.

And the greater the success of the raids of the slave-making ants, the worse it is in the long run for the conquerors. They cease to forage for themselves, leaving the task to their captives. They abandon

habits of cleanliness; they neglect even to feed themselves. Everything is done for them by their tireless slaves.

When the home has to be changed, the slaves must carry their masters, helpless as larvæ. Left to themselves, these conquerors, who slew thousands and wrecked strong places of defense, now starve and die, helpless if denied the daily service of the little slave ants to keep life in them by their ministrations. Self-help for ants as for humans has still much value.

new species of ants to the French Academy of Sciences. The soldiers, enormous creatures, bear on their heads great hollow horns through which, when attacked, they eject poison gas, a vapor of formic acid.

Four months later England had as great a surprise. Keeper Brow of the London Zoo's insect department was cleaning out a nest of common wood-ants when lo, the ants began to bombard him with what seemed to be like the tear gas

Winged foraging ant.

Foraging ant worker.

Sauba ant worker.

Winged sauba ant.

Carpenter ants at rest.

Meadow-ant princess.

Brown meadow-ant worker.

King meadow-ant.

Winged driver ant.

Slave-making ants at war with black ants.

Winged wood-ant.

Such a decline in skill, ardor and independence as we see here is the more striking because it comes about in the life, not of a species, but in that of an individual colony, an individual ant. Every ant born into the world appears to be amply equipped with gifts and cunning. We are always learning new things about these creatures, increasing our astonishment and sense of reverence.

For example, most of us were surprised in the autumn of 1922 when a great French naturalist returned to Europe from Indo-China to reveal a supposedly

which was used during the World War! With streaming eyes he made tests and found that his charges were deliberately fumigating him with vaporized formic acid, after the fashion of the Indo-Chinese ants. He found that the species can discharge their irritating gas to a distance of over eight inches, about thirty times the length of the ant itself.

THE PROFOUND WISDOM WHICH RESIDES IN A TINY HEAD

If the old writers of fables which formerly served for natural history had known but a little of the ways of ants,

what a literature of the impossible they would have added to the common stock of travelers' tales.

But they could not have told anything much more wonderful than the truth. Their methods of communication, their memory, their cunning and skill are all mysteries to us still. We cannot imagine how such profound wisdom can reside in so tiny a horny head. Let us finally group one or two feats in order to increase our respect for these little people.

There were some ants which for several days climbed down a string to a jar which contained sugar. Presently they ceased their journeys, yet got the sugar. Only three or four ants made the whole trip. They brought grains of sugar up the string and dropped it to a ledge below, where the bulk of the ants waited to carry it off to their nest.

Then there was a tiny company of wood-ants which sought to get a great horny beetle home to their larder. It was alive and resisting vigorously, but it moved in the direction the ants desired. Two were in front hauling, and two were behind pushing, but as the ground was rough and the beetle's great legs waved and clutched, one could not understand how the tiny quartet were managing their huge burden. The mystery lay beneath, unseen. Underneath was a fifth ant, supporting the weight of the enormous body on its own.

THE WONDERFUL CLIMB OF A COMPANY OF ANTS

Best of all, perhaps, there is Mr. William Beebe's picture of a great company of fighting ants struggling out of a five-foot pit. They had cleared it of life—beetles, other ants, spiders, grasshoppers, frogs. The way up with their burden, he computed, was as difficult as if we had set men, each carrying a 200-pound weight, to scale a perpendicular cliff 1,200 feet high.

It is a fascinating story, the way they did it, five columns strong. Most of them were heavily laden, but they had disciplined contingents thrown out to pick away loose grains of sand in the path, to grip with feet and jaws and form living anchorages to which the toiling climbers could hold and climb over where places were smooth and treacherous.

But at the top of the ascent, the cliff, absolutely bare and slippery, overhung. Only a solitary ant was able to get up; the rest stayed, apparently defeated. But were they? No. The one successful ant was met at the top by numbers of other ants of the same tribe. There was a hurried consultation between the newcomer and the rest. Then there followed a rush of ants to the edge of the cliff. They formed themselves into a living mat, holding together one to another. Each succeeding line of ants went lower and lower, as bees hang down in a hive when about to form wax for their close-packed cells.

THE LIVING TUNNEL WHICH LED THE ANTS TO SAFETY

The living curtain hung down several inches, when the lowermost ant with great excitement reached down its tentacles and touched the foremost ant of the column halted below. At once the ascent was resumed, aided by the ants hanging from above. The process was a sheer marvel of skill. The lower ants could come up only over the bodies of those hanging down. Since they were so heavily burdened, this was difficult. So the hanging ants grouped themselves circlewise. They formed themselves into a tube. And through the centre of this tube, this tunnel of living ants, the burden-bearers from below, including one which hugged a morsel of frog, climbed up to the table-land above. Such marvelous things these insects do.

There is still much to ponder and perceive in the way of an ant. With its great achievements, its high efficiency, its affection for its own, its love of play, its entertainment of dependents of other genera, with its limitations and native vices, it ranks foremost in its claims on the interest of everyone who has the gift of imagination.

Among the ants we find brigands that rob those weaker than themselves. There are other ants that steal from a larger and richer species. We find evidences of co-operation between species. Sometimes their galleries open into one another, but they keep entirely separate except when attacked. Then both join to repel the enemy. There is a species of ants in New England and Canada which seems to work for a larger species in return for food. They are not slaves, for they have their own nests and raise their own broods. They are "paying guests."

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6417.

The interior of a modern bank.

SPENDING AND SAVING

CONTINUED FROM 6094

SPENDING is a thing that does not need much explanation, but is very puzzling when we come to think about it. The truth is that how we spend, and whether we spend or save, are important things to ourselves and the world.

When we have money in our pockets it may seem that it really matters to ourselves more than to anyone else how we spend it. All sorts of shops invite us to come in and buy. We can turn our money into many different things, according to our tastes. Does it matter what we choose to buy?

We must not be misled by the fact that goods of all sorts are in the shops waiting for us. In fact, the spending amounts to a command for certain workers to be employed. Suppose that, having a quarter, we decide to buy a pot of marmalade. The spending of that quarter sets to work a long line of activities.

The shopkeeper, having sold the pot of marmalade, has one less in stock, and is led to order more; whereas if people stopped buying marmalade he would not buy any more, and so all the industries concerned in making the pot of marmalade would feel the loss.

The marmalade is contained in a pot produced by the glass or earthenware industry, and these industries use raw materials which must be made with coal for fuel, and with machines. The marmalade itself is made out of fruit grown miles away, and boiled with sugar imported perhaps from the West Indies in vessels made in factories. The pot bears a paper label, in the making of which trees are turned into pulp, and pulp into paper, while the printing is done by machinery employing various inks and colors. Other and special sorts of paper have to be made to cover the top of the marmalade, and finally to seal the pot. Yet another industry supplies the thin twine to fasten the cover.

Connected with these processes are workmen, salesmen, packers and others. Wood is made into packing cases, and fastened up with nails which are the product of furnace and mine. Not only so, but these various things are carried by land and sea, from all parts of the world, so that sailors and railwaymen, and cart and truck drivers, all play their part.

How wonderful it is to think of our going into a shop with one quarter and thus commanding, in the buying of one pot of jam, a tiny fraction of the work of hundreds of people. How plain it is, then, that the manner of our spending matters, not only to ourselves, but to all the world of work. Wise spending commands desirable work, while un-

wise spending commands unworthy work. If we buy good things, we order good work to be done. If we buy useless things, we order people to do useless work.

THE SCOFFERS WHO LAUGHED WHEN MARCONI BRIDGED THE OCEAN

The wants of civilized men are numerous, and are always increasing. The human mind is so wonderfully broad in its outlook that it is always discovering new things and longing to enjoy them. Not many years before the World War, Marconi introduced wireless telegraphy, and when he announced that he had signaled the letter S across the Atlantic many people laughed and declared that he had deceived himself. To-day, even in small towns, there are displayed the radio sets which we can install in our own houses in order to listen to lectures, concerts, or dramatic performances broadcasted from wireless stations. Thus, a new want has been created—a new object on which we can spend our money.

Another example, a few years older, is the motor car. Every year sees more and more cars on the roads. Counting in the capacity of motor trucks and motor busses, there are enough to take the whole population of our country riding at the same time. Perhaps you will say that is not really a new expenditure, that the people who have cars had horses, or would have them if there were no cars. This is not true. Before the days of motor cars a few people kept horses for pleasure, but the number was small. Most of the people who now have cars would not have horses if there were no cars. The amount of money spent for cars, and the greater amount spent to keep them running, is a new expense which has developed during the present century.

INCREASED INCOME DOES NOT BRING INCREASED SATISFACTION

A man with an income of $20,000 a year does not get ten times as much satisfaction out of spending it as the man who has only $2,000. No human being needs more than a certain limited quantity of any particular thing. It is a general rule that the more money we have, the less satisfaction we get out of any increased power of spending. Though a man may have an income ten times as great as that of his neighbor, he cannot eat ten times as much or ten times as often, and he cannot wear ten times as many clothes. He can have better food and can have it better served, but there is a limit to this. He can have more suits of clothes, but he can wear only one at a time. He may own several motor cars, but he will not get much, if any, more pleasure out of them than his neighbor gets out of his one cheap car.

The same thing is true of every article of commerce. A boy wants a good bat, but if he has one, he likes to stick to it until it is worn out, and he would not play better if you gave him a hundred bats. Even more important is it to notice that each dollar added to a man's income yields a *diminishing satisfaction* as compared with the previous dollar.

RICH AND POOR FAMILIES AND THE TRADES OF LUXURY AND NECESSITY

If a man has only $1,000 a year to spend, an addition of $100 means a great deal. If, however, he has $5,000 a year, to add $100 matters little, while the addition of $100 to an income of $50,000 a year matters hardly at all. If we take $100 from each, the same rule holds. The difference means a great deal to the first and little to the others.

Such considerations have much to do with the nature of spending. Suppose there are ten poor families each living on about $25 a week, out of which rent, food, clothes and all other expenses must be met. On the other hand, let us take another family which has an income as great as that of the ten poor families together. We can see at once how very differently the two sums of $250 a week will be spent. The ten poor families will need many loaves of bread, and bread will be one of the chief things bought with the $250 a week they have to spend. Because the one rich family has as much income as the ten poor families put together it will not want more bread; probably, indeed, it will eat less bread than the same number of people belonging to the poor families.

On the other hand, the ten poor families will have to spend so much on the bare necessities of life—rent, food, clothes, lighting, coal and household goods—that they will have very little left for luxuries. The rich family, after buying the necessities of life, will have a great deal left to spend on pleasures and luxuries. So we see that the spending of small incomes encourages the trades of necessity, while the spending of large incomes encourages the trades of luxury.

THE WEEKLY HUNT OF THE POOR IN SEARCH OF BARGAINS IN FOOD

Very poor people have to think carefully over the spending of every penny, even to satisfy the humblest wants. In poor streets on Saturday nights poor women may be seen hunting from shop to stall, and from stall to shop, in search of a cheap bit of meat, or a bargain in fish or vegetables, wondering how they are going to make a good meal for their large and hungry families.

With this picture we may contrast the careless spending of those who do not know the meaning of want in its application to the necessaries of life, and who complain bitterly if their luxuries are not exactly to their liking. When we think of such things we come to understand the responsibility of spending, and the desirability of abolishing poverty at one end of the scale and wasteful luxury at the other. Happy is the country which has plenty of wise spenders and not too many reckless and wasteful ones.

It would be a mistake, however, to suppose that the desire to satisfy wants, or to spend money, is bad in itself. It is just because civilized men desire to satisfy a host of different wants, which civilization itself has created, that they are encouraged to work for themselves and for their families. This striving leads to a greater production of wealth, and thus to the means of satisfying wants. It is true that sometimes the pursuit of wealth—the endeavor to get money to spend—leads to feverishness of mind and fretfulness of disposition, but as time goes on, and people learn that men can satisfy one another's needs and create a reasonable supply of good and desirable things for all by co-operation, some of the discomforts and discords of modern life will gradually disappear.

MANY PEOPLE SPEND THEIR INCOMES FOOLISHLY

No one can doubt that much money is spent foolishly. Many people buy things of little value, or things which even do them harm. Sometimes this is to gratify the appetite, and very often it is done for show and to seem richer than the spenders really are. You can see examples of this every day.

The amount spent for alcohol, in spite of all laws, is enormous. The tobacco bill of this country is very large. Some men will deny themselves and their families the necessities of life in order to obtain the means of gratifying their appetites. Money is spent for dozens of other things which do little or no good. Even if they do not do great harm, there are other things for which the money might be spent more wisely.

There is a tendency to spend for showy things rather than for substantial and useful articles. The girl who works often buys clothes which imitate those of the wealthy women she sees, rather than clothes which will give her good service. In order to buy some expensive ornament she may stint herself on food and fail to get sufficient nourishment. Young men sometimes do the same sort of thing.

Wise spending is an art. One should spend one's income, particularly if it is limited, so that it gives the greatest possible satisfaction. Probably spending would be done more wisely if everyone made a budget. This means that one should divide the amount to be spent into parts, allowing so much for shelter, food, clothes, improvement, amusement, and so on. Then the difficulty is to keep from spending more when the amount set aside for any one of these items is exhausted.

THE WISE PEOPLE WHO SAVE A PART OF THEIR MONEY

Fortunately there are some people who, instead of spending all their money, are careful to save a part of it. Let us try to understand what saving is. If a man spends all he receives as he receives it, he has nothing left to fall back on if he gets sick, or if times become bad and he is unable to find work to do. Too many people are careless about saving. It is curious, in this respect, that human beings should be inferior in foresight to some of the animals. Not a few animals, like the squirrel, store food to guard themselves against famine. If you give a squirrel a nut when he is not hungry he buries it in a place from which he can recover it.

But man must save, not only after the manner of the squirrel, by "putting by for a rainy day," but for the purpose of increasing his powers of work.

The simplest form of such saving is this: a man who has tilled a piece of land and grown and harvested a crop takes care to save out of his harvest enough grain to sow as seed the following season. If he were foolish enough to eat all his grain, there would be no seed time, and no next harvest.

THE WAY IN WHICH A MAN CAN SAVE UP HIS LABORS

Another simple illustration of saving may be given. Suppose that it takes a man a whole week to make a tool. In that case he gives up a whole week of his labor, and for what purpose? The answer is that he is *saving up his labor,* putting it into a tool, so that his future labor will be made all the more fruitful.

Simple as these illustrations are, they really cover the whole reason for saving. For, after all, the most complicated machine ever made is only a tool to help us to work better. By saving up money we can feed and support a number of men while they are not producing any food for themselves, so that their work can be directed to making a machine which, when made, will help us to produce far more food and other things than could be produced without it.

Take the wonderful modern agricultural machines with which harvest work is done. A single machine cuts the grain, ties it up in bundles, and leaves it ready to be carted away. With one of these machines a great field of grain, such as may be seen in Canada and the United States, is rapidly harvested with comparatively little work. There are other marvelous appliances to plow and harrow, drill and sow. Thus the raising of grain becomes a process so easily done that good bread can be eaten by hundreds of millions of people, who, if this machinery did not exist, would get very poor food indeed, as men did in the old days of perpetually recurring famines of which we read in history.

THE BENEFITS THAT THRIFT HAS CONFERRED ON THE WORLD

When, therefore, people are wise enough to save money to construct such machines, they really help the world to get plenty of good food. They do the same thing when they lend money to build railways to carry grain on land, and ships to carry it across the seas where it is needed. Without careful saving these things could not be done.

It is the same with the mineral wealth of the earth. Coal, and the ores which yield iron, copper, zinc, lead, tin and other indispensable metals, were just as much the possession of the world a thousand years ago as they are to-day, but they could be used only in tiny quantities because great machines did not exist to work them. Even a hundred years ago the amount of iron used was very small, because men had not discovered how to deal with it in big quantities.

Even if all the machines now invented had been thought of, their invention would have been useless, because there would not have been enough iron to make them with. And to-day, if people stopped saving, and did not by saving enable the great machines to be made, the world would speedily become as poor again as it was centuries ago, when so many people lived in wretched poverty.

You may think that all the great inventions have been made. Your parents, when they were children, thought the same. Yet they have seen the motor car, radio and dozens of other things come into common use. Thousands of inventors are working to invent new things or to improve machines and methods, and many will be successful.

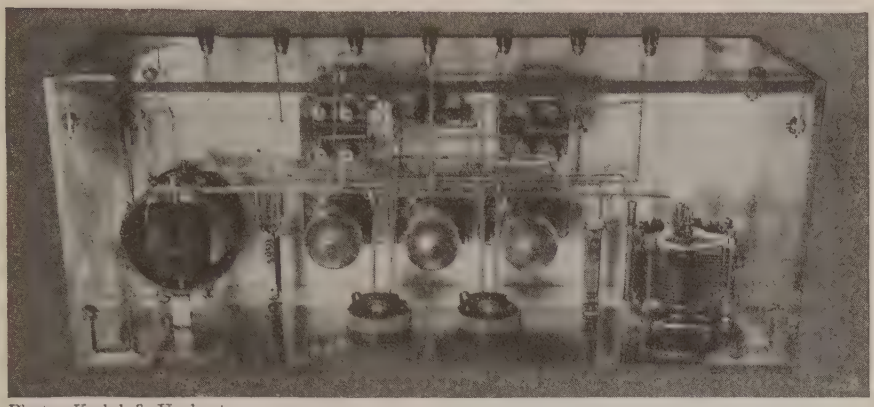
WHY SAVING MAY BE CALLED THE HANDMAID OF INVENTION

Saving is thus seen to be the handmaid of invention. Invention, of course, is the main thing in wealth production. All the saving in the world would not avail much for the benefit of mankind unless science provided us with things in which to invest our savings worthily. But, having great inventions, we should devote our work to carrying them out on a large scale, and that can be done only by saving the means to manufacture them.

All this is very important because our nation, like all the other nations, has not yet made sufficient use of the inventor's ideas, though we do use a great deal of machinery. We want a better output of wealth, and that better output will never arrive until we make the best possible use of all the splendid inventions which we owe to great scientists. If our people would save more, and put their savings into good public and private enterprises, the condition of the nation would rapidly improve.

Wordsworth, in one of his best-known sonnets, wrote that "getting and spending we lay waste our powers." But the poet was anxious to contrast the peace of natural beauty with the feverish haste to be rich. Spending may be wise, though it is often foolish, and wise saving is as worthy of praise as miserly hoarding is deserving of blame.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 6485.



Photo, Kadel & Herbert.

Looking down into the inner secrets of a three-circuit tuner.

THE WONDER OF RADIO

CONTINUED FROM 6189

WE live in an age of marvels. One wonderful invention follows another, and no one can even guess the limits of the inventive power of man. We take all these inventions as a matter of course, and seldom stop to think how different is the world in which we live from the world in which our grandfathers grew up.

We have told you of many of these wonderful inventions. The changes and improvements in methods of communication have been among the greatest of all. We have told you of the locomotive, the steamboat and the airplane; of the phonograph, the telegraph and the telephone. Now we come to radio, the latest of the wonders. If you will read the stories of the telegraph and the telephone first, you will understand radio better.

To make slender wires carry signals or speech seemed a miracle. When it was found that these same signals could be carried without wires, as told on page 6247, the whole world gasped. Scientists were sure that some day speech and other sounds would also be carried, but the spark-gap, about which you will read in the story of the telegraph, did not carry speech very well. Much study and many experiments were necessary before delicate instruments were constructed which would carry clearly and surely the sounds uttered many miles away, and give them back without change. Great progress was made during the World War, but it was not until about 1920 that the radio-telephone became a popular success.

Now its use is almost world-wide. One of our readers may be in a lonely farmhouse among the hills, another in a city apartment, and a third, perhaps, in a lighthouse on an island. The only sounds they hear are the wind in the tree-tops, the dull roar of traffic, or the beat of the waves. With the turn of a knob each may hear the same things. Perhaps the voice of a famous singer is being heard by thousands instead of hundreds; perhaps a great orchestra is playing some masterpiece; perhaps a teller of stories is amusing the little folks; perhaps the scores of baseball games are being given inning by inning, sometimes play by play; perhaps the weather man is telling of an approaching storm, or market reports are being sent out to the farmers. In fact, these broadcasting stations have something

for every member of the family. We shall tell you more of them in a moment.

Now let us see how it is done. What does radio mean? You are told on page 6314 that sound-waves travel through the air at the rate of a mile in about five seconds, though they travel faster through metal. It has been found that electromagnetic waves can be set up in the atmosphere. They travel at the same speed as light; that is, 186,000 miles a second, several hundred thousand times as rapidly as sound-waves. The waves pass not only through the atmosphere, but also through walls, forests and mountains. Some are absorbed, but enough get through to affect the sensitive receiver, but they cannot be felt by any of our five senses. That is, our unaided senses cannot tell whether the air is empty or full of these waves.

The first radio photograph, sent across the Atlantic on November 30, 1924, was of the Prince of Wales.

The waves travel in all directions from the centre from which they begin. Have you ever thrown a pebble into a pond and watched the circles of waves move out to the banks, growing weaker as the distance increases? Radio waves in the atmosphere move in a similar way, except that they move outward in every direction. Perhaps you can understand better the way they spread if you think of a soap-bubble growing larger and larger. Now think of a succession of smaller bubbles, each inside the next larger one and each growing larger and larger; or think of the way the rays of light from a candle spread in every direction. Remember these illustrations, for you will need them again. It is easy to compare radio waves to pond waves, bubbles or light rays.

WHAT DO WE MEAN BY WAVE-LENGTH?

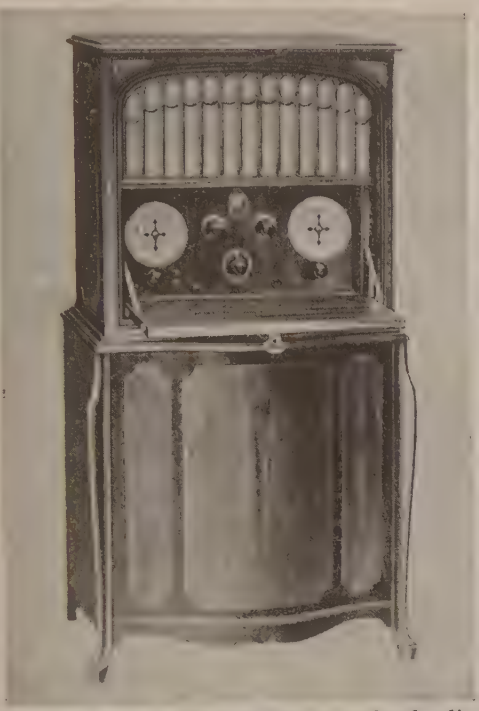
These radio waves are produced by the vibration, or oscillation, of electric current. There is more than one kind of electric current. A direct current flows steadily in one direction, but direct current does not produce radio waves. An alternating current flows in one direction until it reaches its height, flows back, rises again, flows back, and so on, with marvelous rapidity. Each complete change is called a cycle. Ordinary lighting current in an electric lamp goes through about sixty cycles in a second. The rate of radio vibration is much higher—from 20,000 to as much as 6,000,000 cycles every second. This is called "radio frequency."

You have been told that radio waves travel 186,000 miles in a second. It is plain, then, that the length of a wave, by which we mean the distance from the top of one to the top of the next, will be the distance that the current travels in a second divided by the number of vibrations in the same time. Now 186,000 miles is about 300,000,000 metres. This sum divided by 1,000,000, say, gives a wave-length of 300 metres. By regulating the number of cycles different wave-lengths may be obtained. In order to hear clearly, the receiving end must be tuned to the same wave-length sent out by the transmitter.

THE FOUR REQUIREMENTS OF RADIO

Now, how are these waves set in motion and how are they received? These four things are required: (1) a transmitter which will change the sound-waves produced by the voice or musical instrument into electromagnetic, or radio, waves; (2) an antenna, or aerial, which will set them loose in the atmosphere; (3) a receiving antenna which will respond to the waves sent out by another antenna perhaps hundreds of miles away; (4) a receiver which will transform these radio waves back into sound-waves.

RADIO INDOORS AND OUTDOORS



Here we see one of the most highly developed radio receivers that is made. The case as well as the mechanism is the last word in radio achievement.

Here is a portable field set which can be carried anywhere. The antenna is strung from a tree, while the ground connection is easily made.

Photo, Brown Bros.

Our photograph shows Station WJZ, New York, an up-to-date broadcasting studio. The neat little instrument on a pedestal is the modern microphone, which converts sounds into electrical equivalents and enables them to be sent out from the broadcasting machine.

Unless otherwise accredited, the photographs in this article are used by courtesy of the Radio Corporation of America.

It would take a whole book to describe the different kinds of instruments which may be used for sending and receiving. In fact, there are dozens of books which tell how to set up and use radio sets, and the boy or girl who wishes to set up a set, or even to make one, would do well to get one of these books. Our space will not allow us to go into all the details, but in our sections of Things to Make and Things to Do beginning on pages 335 and 5507 we describe the making of simple radio sets.

There are many kinds of transmitters, but the principle is the same in all. There must be a source of electric current. This current must be changed into a high-frequency current. A mouthpiece which responds to sound-waves must be connected with the current, so that the sound-waves may be transformed into radio waves. A wire must lead to the antenna which flings the waves into the atmosphere. This antenna is a wire or wires stretched between two points some distance above the ground. The more expensive sets can be adjusted to give radio waves of several lengths. The cheaper sets cannot be so adjusted.

This line-cut reproduction of President Coolidge was one of the earliest transmitted by the Ranger process. It was sent from Marion, Massachusetts, to the Radio Corporation Laboratory in New York.

WHAT THE SIMPLEST RECEIVING SET REQUIRES

Most of our readers are more interested in receiving than in sending, and the difference between receiving sets is greater than in the sending sets. The very simplest receiving set has an antenna with a wire leading down to the receiving-room, another wire to the ground, a detector which transforms the high-frequency radio waves into currents which travel in one direction only, and a telephone receiver which makes waves audible. The simplest detector is a mineral crystal, which, by allowing the waves to pass through in one direction much better than in another, changes (rectifies) the alternating current into a direct current. The most popular crystal is galena (lead sulphid).

Such a set requires no battery and costs very little, but it can be used only to receive "damped" waves, that is, air-waves sent out by a "spark" transmitter. It is by damped waves that the Morse, or International, codes are sent. Voices or music cannot be heard over this simple set. A tuning coil or a variometer may be added, and then one can select the length of wave one wishes to hear and can "tune-in" on programmes from near-by stations.

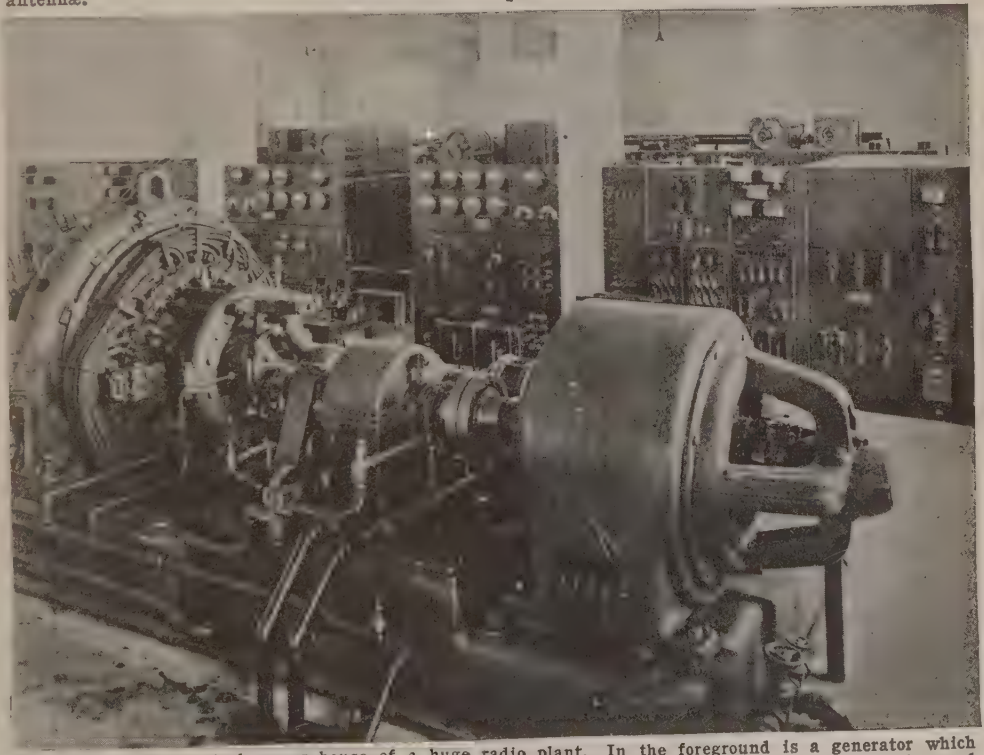
It is possible to make these sets very small. One man has made a set which is fastened to a ring which he wears on his finger. There are pocket sets in which the tiny detector is fastened on the back of a small telephone receiver. Two tiny spools of wire are attached. One wire can be attached to a large umbrella or to a fire escape, or even to an iron bed, which is made to serve as a receiving antenna, and the wire from the other spool is attached to a water pipe or an iron fence, which serves as a ground. With such a set one can pick up waves sent by a powerful station near by.

In fact, in a receiving set an antenna set high in the air is not absolutely necessary. Since the radio waves pass through walls and fill the atmosphere everywhere, a loop antenna set up inside the house is sometimes used. This loop is a wooden frame around which is wound a number of turns of wire spaced about an inch apart. One man, whose landlord would not allow him to set up an antenna on the roof, dropped a wire down the chimney. The radio waves passed through the

WHAT LIES BEHIND A RADIO MESSAGE

Station WJZ, the broadcasting unit of the Radio Corporation of America, has two lofty iron spires on top of the Æolian Hall, New York, to carry its antennæ.

One of the most highly developed and efficient ship installations is that on the great ocean liner the Leviathan. By law all passenger vessels are compelled to have radio outfits.

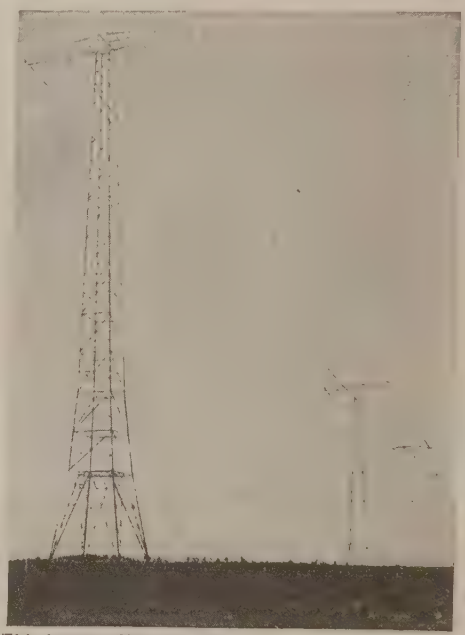


Here we see the central power house of a huge radio plant. In the foreground is a generator which provides the electrical current necessary for the operation of the transmitting set. In the background may be seen the various controls and meters.

bricks, and he was able to hear sending stations near by. Another man ran a wire around the room behind the picture molding. There are receiving sets no longer than a policeman's club which can be carried anywhere. Of course none of these sets is so sensitive as one with a high antenna. In cities, however, the loop antenna is used very extensively. It is possible also to attach the lead-in wire to an insulator which fits into an ordinary electric-light socket and by that means to use the electric wires as an efficient aerial.

THE MARVELOUS VACUUM TUBE

The better sets use one or more vacuum tubes instead of a crystal detector. In fact, these little vacuum tubes make possible radio as we have it to-day. The vacuum tube is a glass tube much like an electric lamp. Within are a tungsten filament (around which is a coil of wire called a grid) and a plate. The vacuum tube has three important uses. In the transmitter it will convert direct current from a storage battery into the high-frequency alternating current which will produce the radio waves and does away with the spark-gap. In the receiver it will take the place of a crystal detector and change radio waves into direct currents, and it can also be used to make the sounds stronger. By using enough vacuum tubes one can increase, or amplify, the sound of a voice so that it can be heard for miles. With vacuum-tube sets electric batteries are necessary.



This is a small part of the aerial wires at the radio station at Port Jefferson. Each of the steel towers is more than 400 feet high. This station communicates with Europe, South America and the Pacific Islands. Photo, Underwood & Underwood.

THE MEN WHO HELPED TO GIVE RADIO TO THE WORLD

No one man can be said to be the inventor of the radio-telephone. The principles are the same as those of the radio-telegraph, though of course it is harder to transmit speech or music than signals. Only a few of the experimenters can be mentioned. Professor R. A. Fessenden made an experimental radio-telephone as early as 1900. Improvements were made by E. W. F. Alexanderson, and again by Valdemar Poulsen. Dr. Lee de Forest, who had already done much for radio-telegraphy, discovered some of the properties of the vacuum tube. The work of Dr. Irving Langmuir and Major E. H. Armstrong is important. There are dozens of others, perhaps equally important, who have advanced radio science.

WHAT IS BROADCASTING?

The great companies which make electrical apparatus worked long and hard to improve and simplify the instruments for radio-telephony. When they succeeded they set up great stations with powerful transmitters in different parts of the country. Each station always uses the same wave-length, which is different from that used by other stations, and flings the waves into the air in every direction. Daily programmes are made up and advertised. Frequently merchants and newspapers use this broadcasting as a means of advertising. At every hour of the day there is something of interest for some member of the family; or, if one has a good receiving set, one can select from a large number of programmes given many miles apart. A family in a little village in the woods can keep in touch with the world.

These broadcasting stations are maintained by the manufacturers, at great expense, in order to increase the demand for instruments. Anyone who can tune his receiver to the proper wave-length can listen in. How long the manufacturers will find it profitable to pay singers, orchestras, lecturers and story-tellers no

ALWAYS IN TOUCH WITH NEWS

The Canadian National Railways has installed radio sets on many of its trains. Our photograph shows clearly the method of arranging the aerial along the top of a car. The man in uniform who is seated on the rear platform is the radio-operator. All the transcontinental trains of the Canadian National Railways have radio equipment.

Here we have the interior of an observation car on the Canadian National Railways. Seated at the radio instrument is the operator. Above the instrument is a loud speaker, but at each chair is a pair of ear phones, so that passengers can choose which method of listening-in they prefer. The Canadian National Railways has a series of broadcasting stations extending across Canada from coast to coast.

Photos, courtesy Canadian National Railways.

one can say. Someone will continue to maintain them, however. Perhaps a small fee will be charged every purchaser of instruments; perhaps the Government will collect a tax from every owner for the purpose of keeping up the stations; perhaps the Government will keep them up just as it maintains schools. The plan is too valuable to be given up.

It is perfectly possible to arrange any auditorium, concert hall or opera house so that the lecture or the music can be sent out into the air to be gathered by listeners for hundreds of miles around, but there is no way of collecting pay for the service. The management objects to sending free, because many people would listen at home instead of paying admission to the performance.

WILL RADIO REPLACE WIRES?

It is not likely that radio will soon take the place of wires entirely, for several reasons. In a great city there are many thousand telephone subscribers. It would be impossible to assign a different wave-length to each individual, and when two stations are sending out the same wave-length there is confusion. In addition, there is as yet no such thing as privacy in radio. Any message sent out can be caught by any receiver which can be tuned to the proper wave-length, and so the most private conversation can be heard by all. It seems that for short distances we shall continue to telephone by means of wires.

On the other hand, radio will be a great addition to wire systems. It is perfectly possible for a subscriber to call up his central by wire, ask to be connected with the radio station, which will call someone on a ship far out at sea to the radio-room on the ship, and the two can then talk with ease. In fact, something like this is done regularly. Santa Catalina Island is a popular summer resort over thirty miles from the California mainland. There is a radio station at Pebbly Beach on the island, and another on the mainland at Long Beach, twenty-five miles from Los Angeles. Any subscriber in Los Angeles can talk with any subscriber on the island. The message goes in this way: from the subscriber to central by wire, to Long Beach by wire, to Pebbly Beach by radio, to an island central by wire, to the individual subscriber by wire. In fact, subscribers in San Francisco often talk to friends on the island by way of Los Angeles, thus adding two more links to the chain.

Captain R. H. Ranger, who developed the apparatus for sending photoradiograms.

For long-distance work radio will become very important. It is expensive to set up and maintain a thousand miles of wire on poles. Powerful radio stations will cost much less, and will serve the purpose quite as well, if not better, for wires are constantly breaking on long lines. Explorers carry radio sets, and men talk across the ocean. Arlington, U. S. A., can talk with Honolulu, Hawaii. Indeed, in January, 1927, regular commercial service by radiophone between New York and London was formally opened.

THE FIRST RADIO PHOTOGRAPH IS SENT FROM ENGLAND

On page 6056 we described the great success which was won by scientists through the discovery of means of sending photographs or pictures by telegraphy. Radio engineers had been working on this problem, too, and on November 30, 1924, the Radio Corporation of America photoradiogram system was used to transmit a photograph across the Atlantic Ocean. This was the photograph of the Prince of Wales which is shown on page 6364.

How a photoradiogram picture is transmitted is described briefly. The picture is first photographed on an ordinary

SENDING AND RECEIVING RADIOGRAMS

This picture shows us the system of automatic transmitters used in an office of the Radio Corporation of America. Recently, by using short waves, commercial circuits have been opened with Europe, South America, San Francisco and Hawaii. No one can prophesy what wonders will be done with the short wave in the future.

Here we see the siphon-recorder receiving set with automatic tape reception as used in the Broad Street, New York, office of the Radio Corporation of America. It has been found possible to send and receive 100 words a minute and also to "operate duplex," which means to send and receive at the same time.

camera film. This is developed and then placed on a glass cylinder, being held firmly in place by metal clips.

Inside this glass cylinder is an incandescent lamp, the light from which is focused in a minute beam on to the film as the cylinder is set in motion. As the light and dark portions of the picture are traversed by the light-beam the intensity of the ray is changed. This ever changing beam, after having passed through the film, is again focused through another lens outside the cylinder on to the sensitive element of a photo-electric cell. This recent development of the General Electric Company transforms the light-waves into electrical impulses, or waves, which can be transmitted by radio much the same as a regular dash-and-dot message.

This photo-electric cell is commonly spoken of in the laboratory as the "eye" of the transmitter. It is able to "see" even the tiniest light variations; in fact, the eye sees and records electrically millions of different current impulses as the film sweeps by the light-beam from inside the cylinder. The photo-electric cell is therefore responsible for reproducing an infinite number of different electric-current values which correspond with the light or dark areas of the picture being transmitted.

In order to cover all of the original film the glass cylinder is rotated back and forth, and in this way the entire surface is eventually exposed to the piercing light-beam. The film rotates through an angle equal to the width of the picture, and the electric camera itself advances down the length of the picture one notch at a time. Thus, line upon line, the whole picture is covered.

After the signal impulses, or electric waves, from the photo-electric cell pass through a series of vacuum-tube amplifiers, they are fed into a modulating device ready for transmission. The electrical interpretation of the picture is then transmitted over land wires from the London laboratory to the Carnarvon, Wales, high-power transmitting station of the Marconi Wireless Telegraph Company, Ltd. Here the electric impulses on the land wire operate small relays which turn on and off the high-value currents flowing from the 200-kilowatt generator to the antenna system. This high-power electrical energy leaving the antenna in interrupted impulses, similar to dots and dashes of the telegraph code, creates the ether waves which carry the photograph through space 3,000 miles to the receiving station on this side of the Atlantic, located at Riverhead, Long Island.

AMERICAN OPERATOR TUNES IN TO RECEIVE THE PICTURE

At Riverhead, in the Radio Corporation's central receiving station, the operator tunes in to the Carnarvon station. He receives the picture just the same as he would a radiogram, but instead of dots and dashes which he can read he receives an undecipherable series of impulses. These pass by land wire to the laboratory of the Radio Corporation located in the building in Broad Street, New York. Here this unintelligible code carrying the photograph is translated back into black and white, recording the original picture much in the style of a stippled engraving. The final operation unscrambles the complex photo message.

The picture is reproduced in duplicate at the receiver, both on a paper record and on a photographic film. The paper upon which the record is made is wrapped about a rotating cylinder which in size and appearance much resembles the early-type wax phonograph record. A specially constructed fountain-pen bears against this just as the needle of the phonograph does on a record. The pen is attached to an electrically controlled lever in such a way that every pulse of electrical current which passes through the magnet coils of the relay lever draws the pen to the surface of the paper, making a fine ink-mark.

The making of the ink record is visible in all its operations. The wiggling of the fountain-pen can be watched as the cylinder rotates back and forth, gradually building up the picture. The photographic record is made on an ordinary camera film inside a specially constructed camera, a beam of light playing upon the film in place of the pen upon the paper. This is developed like any film, and as many prints can be made from it as desired.

One of the outstanding requirements in sending pictures by radio or wire is absolute synchronism of the sending apparatus with the receiving device, otherwise distortion will occur.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6441.

BOYS SHOW THEIR INTEREST IN RADIO

This youngster of five years is interested and has learned to tune the set so that the sounds are clear. Notice the loud-speaker used with this set.

Photos, copyright, Underwood & Underwood.

A schoolboy of Plainfield, New Jersey, only twelve years old, has made a receiver which will fit into an ordinary safety match box.

This fortunate youth can always amuse and interest any of his friends who come to visit him. By using the headbands instead of the loud-speaker they do not disturb other members of the household. Some of the best work in radio is being done by youthful amateurs, and the results will doubtless show in many improvements as they grow older.

Photo, Brown Bros.

FRENCH—THE NOISE IN THE CHIMNEY

First line, French; second line, English word; third line, as we say it in English.

Il est huit heures. La chambre à coucher est noire. Nous sommes presque endormis.
It is eight hours. The room to to sleep is black. We are nearly asleep.
It is eight o'clock. The bedroom is dark. We are almost asleep.

Tout à coup il y a un bruit dans la cheminée. "Qui est là?" dis-je.
All at blow there is a noise in the chimney. "Who is there?" say I.
Suddenly there is a noise in the chimney. "Who is it?" I say.

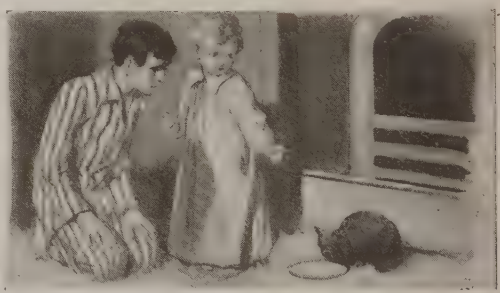
On ne répond pas. La bonne entre; elle frotte une allumette et allume le gaz.
One (not) responds not. The nurse enters; she rubs a match and lights the gas.
There is no answer. Nurse comes in; she strikes a match and lights the gas.

Quelque chose dégringole dans la cheminée et tombe sur le plancher.
Some thing tumbles down in the chimney and falls upon the floor.
Something slides down the chimney and falls on the floor.

Jeannette crie. La bonne dit: "Chut! Vous allez réveiller Bébé."
Jenny cries. The nurse says: "Hush! You go to awaken Baby."
Jenny screams. Nurse says: "Hush! You will wake Baby."

"C'est un petit chat," dis-je. "Il a peur. Puis-je lui donner du lait?"
"This is a little cat," say I. "He has fear. May I to him to give some milk?"
"It is a kitten," I say. "He is frightened. May I give him some milk?"

La bonne tire la sonnette et la servante apporte du lait dans une soucoupe.
The nurse pulls the bell and the servant brings some milk in a saucer.
Nurse rings the bell, and the maid brings some milk in a saucer.



Bébé se réveille et crie: "Joli minet! Puis-je l'avoir dans mon lit?"
Baby himself awakes and cries: "Pretty pussy! May I him to have in my bed?"
Baby wakes up and cries: "Pretty pussy! May I take him to bed?"

Mais la bonne dit: "Nous le mettrons dans cette corbeille près du feu."
But the nurse says: "We him will put in this basket near of the fire."
But Nurse says: "We will put him in this basket near the fire."

Le lendemain il était parti. Peut-être que les fées l'avaient emporté.
The next morning he was departed. Perhaps that the fairies him had carried away.
In the morning he was gone. Perhaps the fairies had taken him away.

THE NEXT FRENCH STORY IS ON PAGE 6464.

THE NORMAN BARON

IN this fine poem by Henry W. Longfellow, the great American poet has taken a subject from the history of England in the early Middle Ages. He was very fond of choosing themes from English history, for, of course, an American poet has fewer incidents to choose from in American history, and must look to the old land of legend and romance for inspiring subjects of song. Longfellow prefixes to his poem a passage from a French history of the Conquest of England, which may be translated thus: "In those moments of life when the thoughts of man become more calm and deepen, and the voice of selfishness speaks less strongly than the voice of reason, when overcome by domestic sorrow, by illness, or under the shadow of death, the barons sometimes repented of having enslaved the people, and felt they had done a thing displeasing to God, who had created all men in His image."

CONTINUED FROM 6256

IN his chamber, weak and dying,
Was the Norman baron lying;
Loud, without, the tempest thundered,
And the castle turret shook.

In this fight was Death the gainer,
Spite of vassal and retainer,
And the lands his sires had plundered,
Written in the Domesday Book.

By his bed a monk was seated,
Who in humble voice repeated
Many a prayer and paternoster,
From the missal on his knee.

And, amid the tempest pealing,
Sounds of bells come faintly stealing,
Bells that, from the neighbouring cloister,
Rang for the Nativity.

In the hall, the serf and vassal
Held, that night, their Christmas wassail;
Many a carol, old and saintly,
Sang the minstrels and the waits.

And so loud these Saxon gleemen
Sang to slaves the songs of freemen,
That the storm was heard but faintly,
Knocking at the castle gates.

Till at length the lays they chaunted
Reached the chamber terror-haunted,
Where the monk, with accents holy,
Whispered at the baron's ear.

Tears upon his eyelids glistened,
As he paused a while and listened,
And the dying baron slowly
Turned his weary head to hear.

"Wassail for the kingly stranger
Born and cradled in a manger!
King, like David, priest, like Aaron,
Christ is born to set us free!"

And the lightning showed the sainted
Figures on the casement painted,
And exclaimed the shuddering baron
"Miserere, Domine!"

In that hour of deep contrition,
He beheld, with clearer vision,
Through all outward show and fashion,
Justice, the Avenger, rise.

All the pomp of earth had vanished,
Falsehood and deceit were banished,
Reason spoke more loud than passion,
And the truth wore no disguise.

Every vassal of his banner,
Every serf born to his manor,
All those wronged and wretched creatures,
By his hand were freed again.

And, as on the sacred missal
He recorded their dismissal,
Death relaxed his iron features,
And the monk replied, "Amen!"

Many centuries have been numbered
Since in death the baron slumbered
By the convent's sculptured portal,
Mingling with the common dust.

But the good deed, through the ages
Living in historic pages,
Brighter glows and gleams immortal,
Unconsumed by moth or rust.

THE AUTHOR'S RESOLUTION IN A SONNET

George Wither was an English poet who reflects the spirit of the Cavalier, or Royalist, party although he fought for Parliament against the king, raising a troop of horse with money from the sale of his estates. His verse is very musical and highly polished.

SHALL I, wasting in despair,
Die because a woman's fair?
Or my cheeks make pale with care
'Cause another's rosy are?
Be she fairer than the day
Or the flowery meads in May—
If she be not so to me,
What care I how fair she be?

Shall my foolish heart be pined
'Cause I see a woman kind;
Or a well disposèd nature
Joinèd with a lovely feature?
Be she meeker, kinder, than
Turtle-dove or pelican,
If she be not so to me,
What care I how kind she be?

Shall a woman's virtues move
Me to perish for her love?
Or her merit's value known
Make me quite forget mine own?
Be she with that goodness blest
Which may gain her name of Best;
If she seem not such to me,
What care I how good she be?

'Cause her fortune seems too high,
Shall I play the fool and die?
Those that bear a noble mind,
Where they want of riches find,
Think what with them they would do
Who without them dare to woo;
And unless that mind I see,
What care I though great she be?

Great, or good, or kind, or fair,
I will ne'er the more despair;
If she loves me, this believe,
I will die ere she shall grieve.
If she slight me when I woo,
I can scorn and let her go;
For if she be not for me,
What care I for whom she be?

ORSAMES' SONG

We have very little of Sir John Suckling's verse that has been preserved. He was a courtier, gay and careless in his living, yet possessed a wit so polished and an ear so fine that each fragment is a little jewel.

WHY so pale and wan, fond lover?
Prithee, why so pale?
Will, when looking well can't move her,
Looking ill prevail?
Prithee, why so pale?

Why so dull and mute, young sinner?
Prithee, why so mute?
Will, when speaking well can't win her,
Saying nothing do't?
Prithee, why so mute?

Quit, quit, for shame this will not move:
This cannot take her.
If of herself she will not love,
Nothing can make her:
The devil take her!

TO LUCASTA, ON GOING TO THE WARS

These verses of Richard Lovelace are justly famed for the last couplet, which is so often quoted.

TELL me not, sweet, I am unkind,
That from the nunnery
Of thy chaste breast and quiet mind
To war and arms I fly.

True, a new mistress now I chase,
The first foe in the field;
And with a stronger faith embrace
A sword, a horse, a shield.

Yet this inconstancy is such
As you, too, shall adore,—
I could not love thee, dear, so much,
Loved I not honor more.

NIGHT

William Blake's verse is very musical and simple. We meet his animals and angels very often.

THE sun descending in the west,
The evening star does shine,
The birds are silent in their nest,
And I must seek for mine.
The moon, like a flower
In heaven's high bower,
With silent delight,
Sits and smiles on the night.

Farewell, green fields and happy grove,
Where flocks have ta'en delight;
Where lambs have nibbled, silent move
The feet of angels bright;
Unseen, they pour blessing,
And joy without ceasing,
On each bud and blossom,
And each sleeping bosom.

They look in every thoughtless nest,
Where birds are covered warm;
They visit caves of every beast,
To keep them all from harm.
If they see any weeping
That should have been sleeping,
They pour sleep on their head,
And sit down by their bed.

When wolves and tigers howl for prey
They pitying stand and weep,
Seeking to drive their thirst away,
And keep them from the sheep.
But if they rush dreadful,
The angels, most heedful,
Receive each mild spirit,
New worlds to inherit.

And there the lion's ruddy eyes
Shall flow with tears of gold:
And pitying the tender cries,
And walking round the fold:
Saying: "Wrath by His meekness,
And by His health, sickness,
Are driven away
From our immortal day.

"And now beside thee, bleating lamb,
I can lie down and sleep,
Or think on Him who bore thy name,
Graze after thee, and weep.
For washed in life's river,
My bright mane forever
Shall shine like the gold,
As I guard o'er the fold."

THE LAY OF THE LAST MINSTREL

This is another and very familiar example of Sir Walter Scott's romantic poetry. The scene of the story is the borderland between England and Scotland, where Sir Walter lived, and whose legends he loved to relate. The words of the minstrel's own song are not given here. The minstrel of the past was one of the many picturesque figures that vanished with the changing ages, and we fear that the wandering singers and musicians of our own time are poor substitutes for him.

THE way was long, the wind was cold;
The Minstrel was infirm and old;
His withered cheek, and tresses grey,
Seemed to have known a better day;
The harp, his sole remaining joy,
Was carried by an orphan boy.
The last of all the bards was he,
Who sung of Border chivalry;
For, well-a-day! their date was fled;
His tuneful brethren all were dead;
And he, neglected and oppressed,
Wished to be with them, and at rest.

No more, on prancing palfrey borne,
He carolled, light as lark at morn;
No longer courted and caressed,
High placed in hall, a welcome guest,
He poured to lord and lady gay
The unpremeditated lay.
Old times are changed, old manners gone,
A stranger filled the Stuarts' throne;
The bigots of the iron time
Had called his harmless act a crime;
A wandering harper, scorned, and poor,
He begged his bread from door to door,
And tuned, to please a peasant's ear,
The harp a king had loved to hear.

He passed where Newark's stately tower
Looks out from Yarrow's birchen bower;
The Minstrel gazed with wistful eye;
No humbler resting-place was nigh.
With hesitating step, at last,
The embattled portal-arch he passed,
Whose ponderous grate and massy bar
Had oft rolled back the tide of war;
But never closed the iron door
Against the desolate and poor.
The duchess marked his weary pace,
His timid mien and reverend face,
And bade her page the menials tell,
That they should tend the old man well;
For she had known adversity,
Though born in such a high degree;
In pride of power, in beauty's bloom
Had wept o'er Monmouth's bloody tomb!

When kindness had his wants supplied,
And the old man was gratified,
Began to rise his minstrel pride:
And he began to talk anon,
Of good Earl Francis, dead and gone,
And of Earl Walter—rest him God!—
A braver ne'er to battle rode:
And how full many a tale he knew
Of the old warriors of Buccleuch;
And would the noble duchess deign
To listen to an old man's strain,
Though stiff his hand, his voice though weak,
He thought e'en yet, the sooth to speak,
That, if she loved the harp to hear,
He could make music to her ear.

The humble boon was soon obtained;
The aged Minstrel audience gained.
But, when he reached the room of state,
Where she with all her ladies sate,
Perchance he wished his boon denied;
For, when to tune his harp he tried,
His trembling hand had lost the ease
Which marks security to please;
And scenes, long past, of joy and pain,
Came wildering o'er his aged brain.
He tried to tune his harp in vain,
The pitying duchess praised its chime,
And gave him heart, and gave him time,
Till every string's according glee
Was blended into harmony.
And then, he said, he would full fain
He could recall an ancient strain,
He never thought to sing again;
It was not framed for village churls,
But for high dames and mighty earls;
He had played it to King Charles the Good,
When he kept court in Holyrood;
And much he wished, yet feared to try,
The long-forgotten melody.
Amid the strings his fingers strayed,
And an uncertain warbling made;
And oft he shook his hoary head.
But when he caught the measure wild
The old man raised his face and smiled;
And lightened up his faded eye
With all a poet's ecstasy!
In varying cadence, soft or strong,
He swept the sounding chords along;
The present scene, the future lot—
His toils, his wants—were all forgot.
Cold indifference, and age's frost,
In the full tide of song were lost;
Each blank, in faithless memory void,
The poet's glowing thought supplied;
And, while his harp responsive rung,
'Twas thus the latest Minstrel sung.

. . . . . .

Hushed is the harp—the Minstrel gone.
And did he wander forth alone?
Alone, in indigence and age,
To linger out his pilgrimage?
No. Close beneath proud Newark's tower
Arose the Minstrel's lowly bower;
A simple hut; but there was seen
The little garden hedged with green,
The cheerful hearth, and lattice clean.

. . . . . .

So passed the winter's day, but still,
When summer smiled on sweet Bowhill,
And July's eve, with balmy breath,
Waved the bluebells on Newark heath;
When throstles sung on Harehead shaw,
And corn waved green on Carterhaugh,
And flourished broad, Blackandro's oak,
The aged harper's soul awoke!
Then would he sing achievements high
And circumstance of chivalry,
Till the rapt traveller would stay,
Forgetful of the closing day;
And noble youths, the strain to hear,
Forsook the hunting of the deer;
And Yarrow, as he rolled along,
Bore burden to the Minstrel's song.

ON HIS BLINDNESS

In his forty-fourth year Milton, whose sight had been failing for ten years, became totally blind. Yet he wrote steadily until his death, twenty-two years later.

WHEN I consider how my light is spent,
Ere half my days in this dark world and wide,
And that one talent, which is death to hide,
Lodged with me useless, though my soul more bent
To serve therewith my Maker, and present
My true account, lest He returning chide;
"Doth God exact day-labor, light denied?"
I fondly ask; but Patience, to prevent
That murmur, soon replied: "God doth not need
Either man's work or His own gifts; who best
Bear His mild yoke, they serve Him best; His state
Is kingly; thousands at His bidding speed,
And post o'er land and ocean without rest;
They also serve who only stand and wait."

THE RECONCILIATION

This little poem is one of the many lovely songs that occur in The Princess, written by Alfred, Lord Tennyson.

AS through the land at eve we went,
And plucked the ripened ears,
We fell out, my wife and I,—
Oh, we fell out, I know not why,
And kissed again with tears.

For when we came where lies the child
We lost in other years,
There above the little grave,
Oh, there above the little grave,
We kissed again with tears.

OLD FRIENDS

WE just shake hands at meeting
With many that come nigh,
We nod the head in greeting
To many that go by.
But we welcome through the gateway
Our few old friends and true;
Then hearts leap up and straightway
There's open house for you,
Old friends,
Wide-open house for you.

The surface will be sparkling,
Let but a sunbeam shine,
But in the deep lies darkling
The true life of the wine.
The froth is for the many,
The wine is for the few;
Unseen, untouched of any,
We keep the best for you,
Old friends,
The very best for you.

"The many" cannot know us,
They only pace the strand
Where at our worst we show us,
The waters thick with sand;
But out beyond the leaping
Dim surge "'tis clear and blue,"
And there, old friends, we're keeping
A waiting calm for you,
Old friends,
A sacred calm for you.

BELIEVE ME, IF ALL THOSE ENDEARING YOUNG CHARMS

This is one of the most popular of Thomas Moore's songs, and its musical setting is known to all of us.

BELIEVE me, if all those endearing young charms
Which I gaze on so fondly to-day,
Were to change by to-morrow, and fleet in my arms,
Like fairy-gifts fading away,
Thou would'st still be adored, as this moment thou art,
Let thy loveliness fade as it will,
And around the dear ruin each wish of my heart
Would entwine itself verdantly still.

It is not while beauty and youth are thine own,
And thy cheeks unprofaned by a tear,
That the fervor and faith of a soul can be known,
To which time will but make thee more dear;
No, the heart that has truly loved never forgets,
But as truly loves on to the close,
As the sun-flower turns on her god, when he sets,
The same look which she turned when he rose.

LIGHT

This charming poem was written by F. W. Bourdillon. Set to music, it became a popular love-song.

THE night has a thousand eyes
And the day but one;
Yet the light of the bright world dies
With the dying sun.

The mind has a thousand eyes,
And the heart but one;
Yet the light of a whole life dies
When love is done.

HIAWATHA'S BROTHERS

This extract is from Longfellow's Song of Hiawatha.

THEN the little Hiawatha
Learned of every bird its language,
Learned their names and all their secrets,
How they built their nests in summer,
Where they hid themselves in winter,
Talked with them whene'er he met them,
Called them "Hiawatha's Chickens."
Of all beasts he learned the language,
Learned their names and all their secrets,
How the beavers built their lodges,
Where the squirrels hid their acorns,
How the reindeer ran so swiftly,
Why the rabbit was so timid,
Talked with them whene'er he met them,
Called them "Hiawatha's Brothers."

WINTER

This charming stanza is by Walter Savage Landor.

SUMMER has doft his latest green,
And Autumn ranged the barley-mows
So long away then have you been?
And are you coming back to close
The year? It sadly wants repose.

TO A WATERFOWL

William Cullen Bryant, who was born at Cummington, in the state of Massachusetts, November 3, 1794, and died in New York, June 12, 1878, was one of the greatest poets America has produced. In his poetry we find a deep understanding of nature, and a steady, serene faith in the Providence which guides the wondrous life of earth.

WHITHER, midst falling dew,
While glow the heavens with the last steps of day,
Far, through their rosy depths, dost thou pursue
Thy solitary way?

Vainly the fowler's eye
Might mark thy distant flight to do thee wrong,
As, darkly painted on the crimson sky,
Thy figure floats along.

Seek'st thou the splashy brink
Of weedy lake, or marge of river wide,
Or where the rocking billows rise and sink
On the chafed ocean-side?

There is a Power whose care
Teaches thy way along that pathless coast—
The desert and illimitable air—
Lone wandering, but not lost.

All day thy wings have fanned,
At that far height, the cold, thin atmosphere.
Yet stoop not, weary, to the welcome land,
Though the dark night is near.

And soon that toil shall end;
Soon shalt thou find a summer home and rest,
And scream among thy fellows; reeds shall bend
Soon o'er thy sheltered nest.

Thou'rt gone, the abyss of heaven
Hath swallowed up thy form; yet, on my heart
Deeply hath sunk the lesson thou hast given,
And shall not soon depart.

He who, from zone to zone,
Guides through the boundless sky thy certain flight,
In the long way that I must tread alone,
Will lead my steps aright.

A TERNARIE OF LITTLES

The word "ternarie" signifies a group of any three things, each of which may be different. Thus Robert Herrick, whose famous poem Fair Daffodils we read on page 2527, has given the above title to these very dainty verses because in each one of them he mentions three "littles."

A LITTLE saint best fits a little shrine,
A little prop best fits a little vine;
As my small cruse best fits my little wine.

A little seed best fits a little soil,
A little trade best fits a little toil;
As my small jar best fits my little oil.

A little bin best fits a little bread,
A little garland fits a little head;
As my small stuff best fits my little shed.

A little hearth best fits my little fire,
A little chapel fits a little choir;
As my small bell best fits my little spire.

A little stream best fits a little boat,
A little lead best fits a little float;
As my small pipe best fits my little note.

BABYLAND

This charming little poem recalls the children's verses of the late Eugene Field, which we know so well, but it is not by him, having been written by an author named George Cooper.

"HOW many miles to Babyland?"
"Any one can tell!
Up one flight;
To the right.
Please to ring the bell."

"What can you see in Babyland?"
"Little folks in white—
Downy heads,
Cradle-beds,
Faces pure and bright."

"What do they do in Babyland?"
"Dream and wake, and play,
Laugh and crow,
Shout and grow.
Jolly times have they!"

"What do they say in Babyland?"
"Why, the oddest things!
Might as well
Try to tell
What a birdie sings!"

"Who is the Queen of Babyland?"
"Mother, kind and sweet;
And her love,
Born above,
Guides the little feet."

UNKINDNESS

George Herbert's mother, Lady Magdalene Herbert, was a gracious clever woman who exercised great influence over the mind of her son. The singular flavor of Herbert's poems, their spiritual quality, their devoutness, quiet content, loving gentleness reveal to us a very winning personality. At quiet Bemerton many of his parishioners put down their tasks to go to daily services in the little chapel.

LORD, make me coy and tender to offend:
In friendship first, I think, if that agree
Which I intend
Unto my friend's intent and end;
I would not use a friend as I use Thee.

If any touch my friend or his good name,
It is my honor and my love to free
His blasted fame
From the least spot or thought of blame;
I could not use a friend as I use Thee.

My friend may spit upon my curious floor.
Would he have gold? I lend it instantly;
But let the poor,
And Thee within them, starve at door;
I cannot use a friend as I use Thee.

When that my friend pretendeth to a place,
I quit my interest, and leave it free;
But when Thy grace
Sues for my heart, I Thee displace;
Nor would I use a friend as I use Thee.

Yet can a friend what Thou hast done fulfil?
O, write in brass, "My God upon a tree
His blood did spill,
Only to purchase my good-will";
Yet use I not my foes as I use Thee.

SAY NOT, THE STRUGGLE NAUGHT AVAILETH

Arthur Hugh Clough is one of the most noteworthy among the lesser poets of England. Born in Liverpool on New Year's Day, 1819, he died in Florence, November 13, 1861. His poetry is not only beautiful in form but is weighted with thought, and these four short verses make up a little gem of poetic form and inspiring thought.

SAY not, the struggle naught availeth,
The labour and the wounds are vain;
The enemy faints not, nor faileth,
And as things have been they remain.

If hopes were dupes, fears may be liars;
It may be, in yon smoke concealed,
Your comrades chase e'en now the fliers,
And, but for you, possess the field.

For while the tired waves, vainly breaking,
Seem here no painful inch to gain,
Far back, through creeks and inlets making,
Comes silent, flooding in, the main.

And not by eastern windows only,
When daylight comes, comes in the light;
In front the sun climbs slow, how slowly!
But westward, look, the land is bright!

LITTLE WHITE LILY

Dr. George Macdonald contrives in these pretty little verses to state a simple fact from the life of the flowers in language that is at once childlike and yet expressive.

LITTLE white Lily
Sat by a stone,
Drooping and waiting
Till the sun shone.
Little white Lily
Sunshine has fed;
Little white Lily
Is lifting her head.

Little white Lily
Said: "It is good;
Little white Lily's
Clothing and food."
Little white Lily
Drest like a bride!
Shining with whiteness
And crown'd beside!

Little white Lily
Droopeth with pain,
Waiting and waiting
For the wet rain.
Little white Lily
Holdeth her cup,
Rain is fast falling
And filling it up.

Little white Lily
Said: "Good again,
When I am thirsty
To have nice rain;
Now I am stronger,
Now I am cool;
Heat cannot burn me,
My veins are so full."

Little white Lily
Smells very sweet:
On her head sunshine,
Rain at her feet.
"Thanks to the sunshine,
Thanks to the rain!"
Little white Lily
Is happy again!

THE INDUSTRY OF ANIMALS

We here give another of the poems of Thomas Miller, the poor basket-maker who became a poet and author of some note. Only eight of the original nine stanzas are printed here.

THE lute-voiced birds rise with the light,
Their nestling young to feed,
Pursue the insects in their flight,
Or pluck the feathery seed.

The golden-belted humming-bird
Goes toiling hour by hour,
Over the moor and distant lea,
Wherever grows a flower.

With weary journeys up and down,
He home his honey brings,
From gardens in the distant town,
And while he labours sings.

The long-tailed field-mouse to the wood
Makes journeys many a score,
And in a granary piles his food,
And hoards his wintry store.

Within the hollow of a tree
The nimble squirrel hides
His meat and nuts right cunningly,
And for the cold provides.

His home the mole makes underground,
With runs and chambers crossed
And galleries circling round and round
In which you would be lost.

There's not an insect crawls or flies
But what has work to do,
And the same God their wants supplies
Who watcheth over you.

No single thing did God create
But He for it gave food,
And whether it be small or great,
"He saw that it was good."

AULD LANG SYNE

There is probably no song in any language that has ever attained such a world-wide and enduring popularity as this famous song, partly, if not entirely, written by Robert Burns. Like most of his popular songs, these words were composed for an old tune, though not for the tune to which it is usually sung, that being also an old Scotch melody. *Lang syne* means long since, *pint-stoup* a liquid measure, *braes* hill-slopes, *gowans* daisies, *fit* foot, *burn* stream, *dine* dinner-time, *fiere* friend, *gude-willie waught* hearty draft.

SHOULD auld acquaintance be forgot,
And never brought to mind?
Should auld acquaintance be forgot,
And auld lang syne?

For auld lang syne, my jo,
For auld lang syne,
We'll tak' a cup o' kindness yet,
For auld lang syne.

And surely ye'll be your pint-stoup,
And surely I'll be mine;
And we'll tak' a cup o' kindness yet,
For auld lang syne.

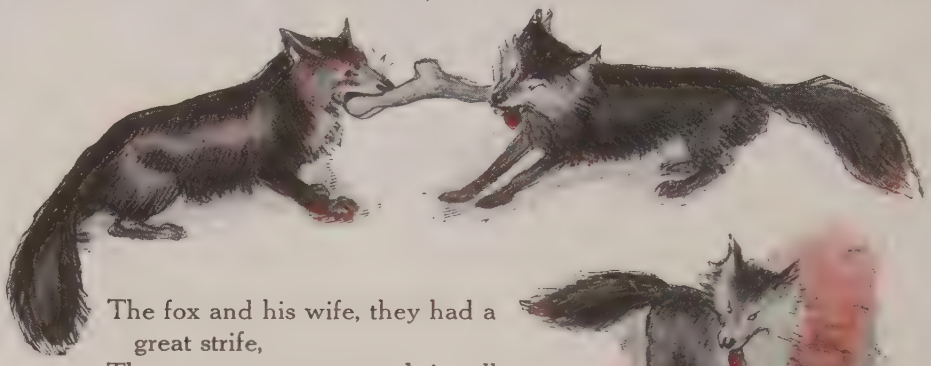
We twa hae run about the braes,
And pu'd the gowans fine;
But we've wander'd mony a weary fit
Sin' auld lang syne.

We twa hae paidled i' the burn
Frae morning sun till dine;
But seas between us braid hae roar'd
Sin' auld lang syne.

And there's a hand, my trusty fiere,
And gie's a hand o' thine;
And we'll tak' a right gude-willie waught,
For auld lang syne.

ONE, TWO
BUCKLE MY SHOE;
THREE, FOUR
KNOCK AT THE DOOR;
FIVE, SIX
PICK UP STICKS;
SEVEN, EIGHT
LAY THEM STRAIGHT;
ELEVEN, TWELVE
DIG AND DELVE;
NINE, TEN
A GOOD FAT
HEN;
THIRTEEN,
FOURTEEN,
MAIDS
A'COURTING;
FIFTEEN, SIXTEEN, MAIDS IN THE KITCHEN;
SEVENTEEN, EIGHTEEN, MAIDS A'WAITING;
NINETEEN, TWENTY, MY PLATE'S EMPTY.
S.C. BURNSIDE

THE FOX AND HIS WIFE, THEY HAD A GREAT STRIFE



The fox and his wife, they had a great strife,
They never eat mustard in all their whole life;
They eat their meat without fork or knife,
And long to be picking a bone, e-ho!

The fox jumped up on a moonlight night;
The stars they were shining, and all things bright;
"Oh, ho!" said the fox, "it's a very fine night
For me to go through the town, e-ho!"

The fox when he came to the yonder stile,
He lifted his lugs and he listened awhile!
"Oh, oh," said the fox, "it's but a short mile
From this unto yonder wee town, e-ho!"

The fox when he came to the farmer's gate,
Who should he see but a farmer's drake;
"I love you well for your master's sake,
And long to be picking your bones, e-ho!"

The grey goose she ran round the haystack,
"Oh, oh!" said the fox, "you are very fat;
You'll grease my beard and ride on my back
From this into yonder wee town, e-ho!"

Old Gammer Hipple-hopple hopped out of bed,
She opened her casement, and popped out her head;
"Oh, husband, oh, husband, the grey goose is dead,
And the fox is gone through the town, oh!"

Then the old man got up in his red cap,
And swore he would catch the fox in a trap;
But the fox was too cunning, and gave him the slip,
And ran through the town, the town, oh!

When he got up to the top of the hill,
He blew his trumpet both loud and shrill,
For joy that he was safe
Through the town, oh!

When the fox came back to his den,
He had young ones both nine and ten,
"You're welcome home, daddy, you may go again,
If you bring us such nice meat
From the town, oh!"

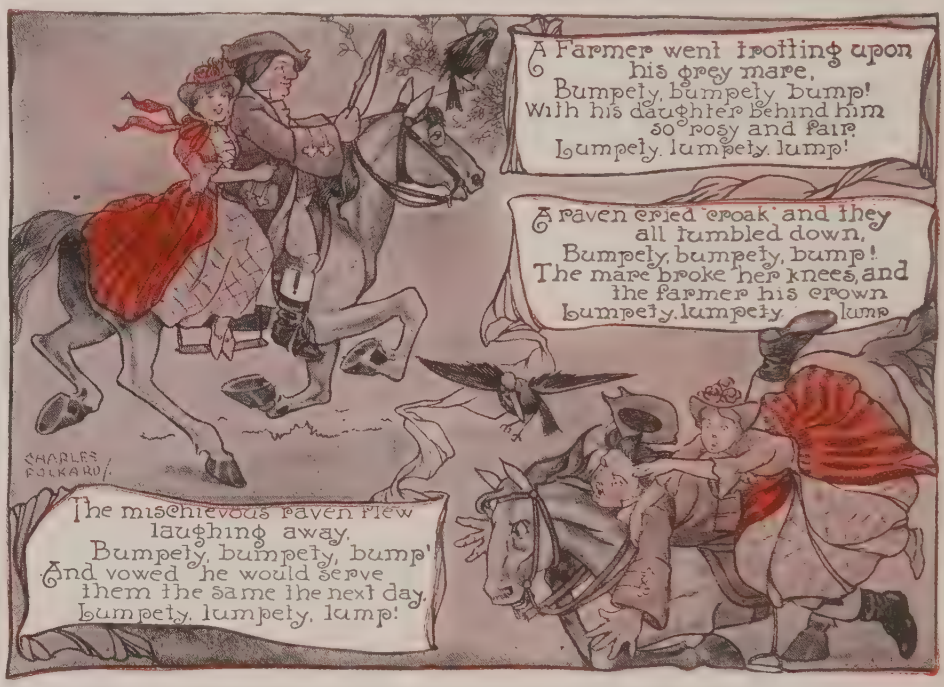
AS I went to Bonner,
I met a pig
Without a wig,
Upon my word and honor.

THERE was a jolly miller
Lived on the River Dee;
He worked and sang from morn till night,
No lark so blithe as he;
And this the burden of his song
For ever used to be—
I jump mejerrime jee!
I care for nobody—no! not I,
Since nobody cares for me.

WE are all in the dumps,
For diamonds are trumps,
The kittens are gone to St. Paul's,
The babies are bit,
The moon's in a fit,
And the houses are built without walls.

WHAT is the news of the day,
Good neighbor, I pray?
They say the balloon
Is gone up to the moon!

MARCH winds and April showers
Bring forth May flowers.


A Farmer went trotting upon his grey mare,
Bumpety, bumpety, bump!
With his daughter behind him so rosy and fair
Lumpety, lumpety, lump!
A raven cried 'croak' and they all tumbled down,
Bumpety, bumpety, bump!
The mare broke her knees, and the farmer his crown
Lumpety, lumpety, lump!
The mischievous raven flew laughing away,
Bumpety, bumpety, bump!
And vowed he would serve them the same the next day,
Lumpety, lumpety, lump!
CHARLES FOLKARD

HIGH diddle ding,
Did you hear the bells ring?
The Parliament soldiers are gone to the King!
Some they did laugh, some they did cry
To see the Parliament soldiers pass by.

WEE Willie Winkie runs through the town,
Upstairs and downstairs in his night-gown,
Rapping at the window, crying through the lock,
"Are the children in their beds, for now it's eight o'clock?"

ONE misty, moisty morning,
When cloudy was the weather,
There I met an old man
Clothed all in leather;
Clothed all in leather,
With cap under his chin—
How do you do, and how do you do,
And how do you do again?

HECTOR PROTECTOR was dressed all in green;
Hector Protector was sent to the Queen.
The Queen did not like him,
No more did the King;
So Hector Protector was sent back again.

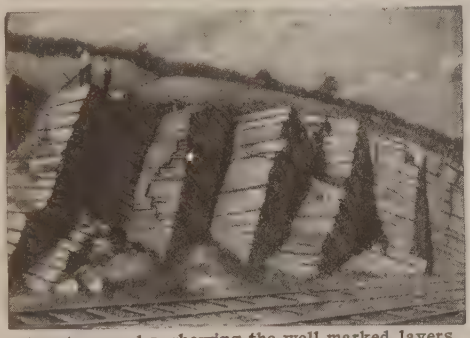
HOW TO KNOW THE ROCKS

CONTINUED FROM 6264

IT is very interesting, not only to those who are ambitious to become skilled geologists, but to all of us, to be able, as we go about in different parts of the country, to tell what kinds of rocks there are round about us. Especially does it add to the interest of a railway journey, if, as we pass through cuttings or enter and leave tunnels, we can, on looking out of the windows, say what the rock formations are that we are passing, and to what period of the world's history they belong.

As we read in the chapter beginning on page 525, the earth's crust is made up of various layers of rock, some parts of it formed by the action of water, and other parts due to the action of fire. On page 4623 we tell how to make a collection of rocks that will teach us a great deal about the earth's history. But if we can get to understand, in a general way, by the appearance or the shape of the hills and cliffs, the particular kinds of rock of which they are made, we shall find that we have a much greater interest in all that we know and read of the earth's past history, away in the very remotest times, and we shall know, also, where to look for new specimens to go into our collection of rocks.

Of course, when the surface of hills and cuttings is covered with soil and is grown over by grass and ferns and bushes it is impossible to see the rock under the soil. Then, again, where the bare surface of the cliff is exposed, the rock is sometimes so affected by the action of the weather that it is almost, if not quite, unrecognizable to the eye at a distance.



Limestone rocks, showing the well-marked layers.

When the rocks themselves can be seen exposed to view, as in a more or less perpendicular cliff or in a very steep cutting, it will be at once noticed that the rock has one of two general characters. Either it is in layers, or *strata*, as they are called, or it has no such regular arrangement. Although not invariably, it may usually be taken for granted that the stratified rocks—those in layers—were formed by the action of water, while the non-stratified, or irregular, rocks are

Conglomerate (pudding-stone) with pebbles imbedded.

the result of fire. There are some formations of rocks known as metamorphosed, or changed, rocks, which are more or less in layers, though these are not so pronounced as the stratified rocks. They were originally formed by water, but have since been affected by fire, which has so changed them that they have but little resemblance to their original form.

First of all, we shall learn the character and appearance of some of the stratified rocks. There is limestone, which is so much used for building, making cement, statuary and other purposes. It varies a great deal, being sometimes white, resembling loaf-sugar in both color and texture. An exposed layer of this is very striking. Limestone is sometimes cream-color or dull yellow, varying to blue-gray, and while it is often close-grained, or built up of tiny crystals, it is also at other times like chalk. Marble is really a limestone. There is a sort of limestone called oölite, which is made up of round grains that give it the appearance of a fish's roe. A bluish variety found in Indiana is a popular building stone. Many varieties of marble of almost every color are found in both Canada and the United States. In many places there are many large quarries which employ thousands of men. Very little marble fit for statuary has been quarried in North America up to the present, though it is believed that much exists.

In chalk cliffs we see many nodules, or rounded lumps, of a hard black, gray or brown rock, which, when split, have a more or less transparent edge. These pieces are made of the ordinary common flint. Sandstone looks like what its name implies—a stone made up of grains of sand. It varies, of course, according to the size and color of the grains, some sandstone being coarse and others fine-grained, while the color may be red, brown, yellow or green. The strata, or layers, are usually very plain. It is the ease with which some kinds of sandstone can be split along the layers that renders this particular rock so useful for many purposes. Sandstone is very widely distributed. In North America it is found from the Atlantic to the Pacific, and is very widely used for building purposes.

Another interesting rock, known as conglomerate, or pudding-stone, can usually be identified. As we pass through a cutting, or see it along the face of a cliff, it looks, as its name indicates, like a plum-pudding. Big and little pebbles are thickly imbedded in a layer of sandstone, and look something like the plums and currants in a Christmas pudding. When the pebbles are sharp and angular instead of rounded, as we sometimes notice, the rock is called breccia.

The rocks formed by fire are as varied as those that owe their construction to the action of water. Granite we all know, whether it be red or gray, because it is the stone used for curbs in all our towns and cities. A pitch-like stone, varying in color from green to brown and yellow, that may be seen in veins or masses bursting through other rocks in Europe or South America, is pitchstone. Basalt is easily recognized by its black, uniform color and its curious structure, which is in columns, like the Giant's Causeway, which we see on page 2931, and on the shores of Lake Superior.

Very often we see crossing another rock a vein of a dull, dirty-green color, streaked with brown or red. This is the well-known serpentine that looks so beautiful when polished and made up into ornaments. It is found usually with the limestone rocks.

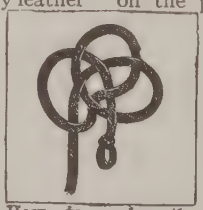
The metamorphosed, or changed, rocks have, as might be supposed, an appearance which somewhat resembles both of the other kinds of rock—those formed by fire and those by water.

There is a rock that looks like granite, but the minerals of which it is composed are arranged more or less in layers. It has been called stratified granite, but it is really gneiss. Another rock, which has a slaty appearance at a distance, and consists of layers of white quartz and mica, is known as mica-schist. The thickness of the layers of each mineral varies greatly, but mica-schist always has an appearance that once recognized, cannot be mistaken. These are the two principal rocks of the metamorphose class that occur, and we can find examples of them almost anywhere.

It is, of course, very difficult to give such details as shall enable us to identify all the different kinds of rocks found in the whole country, but the hints given should prove useful. And if when we travel or go for a holiday we take a small geological map with us, we shall be better equipped for our recreation of identifying the various formations of rock through which we pass.

A BUTTON MADE FROM A SHOE-LACE

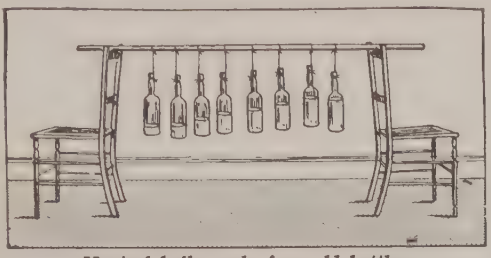
IT may interest us to know how we can make a button for a coat from an ordinary leather shoe-lace. We take the shoe-lace and make a loop at one end, just as we should make a loop in a piece of string. The loop should not be too big, as it is to be used for attaching the button, when completed, to a coat. The plan to follow in making the button is to tie a series of knots, taking care to keep the button round and neat as we make it. It is sufficient to keep on tying simple knots, one on top of another, until the button is the required size. But if we want to make a really attractive button, we should loop the shoe-lace on the principle shown in the picture. We need not stop at three loops, but can continue the series on the same plan, and then pull the whole tight, when, if we have been careful, we shall have a neat round button. A little practice will soon enable us to invent other designs for our shoe-lace buttons. The best plan is to practice for a time with a piece of thick string until we thoroughly understand how to tie the knots so that the button may be round, like a little ball. The final knot should be securely fixed.



How to make the button.

MUSICAL INSTRUMENT FROM OLD BOTTLES

AN amusing and clever musical instrument may be made from a number of old bottles, such as we buy lime-juice or vinegar in. Even medicine bottles will do, but the bottles should be all the same size. Having collected our bottles, we take an ordinary broomstick and rest this on the backs of two chairs as shown in the picture. Then we tie the bottles to this stick, so that they hang loosely and not too close together. Now comes the work of tuning up, and this we may do by pouring water into the bottles, a different quantity into each, putting more water for a low note and less for a high. To get the note of each, we tap it with a stick—the edge of a boxwood rule is a very good thing for this purpose. With patience and perseverance and a little ordinary care and skill, we shall at last have our bottles all tuned and ready for use, and we can now play the curious instrument by striking the bottles with the edge of the rule. Of course the bottles must be strong, so that the striking will not break them; but we need not strike very hard. It will be found that simple tunes can be played on the bottle-bells, and after some practice we can take two sticks and play difficult tunes. It is, of course, essential that the bottles should be hung at such a distance that they do not knock against each other when struck. Much fun can be obtained from this homemade instrument. It should be used only out of doors so that in case the bottles break, the water will run out on the ground, and thus do no damage. However, there is no need for any such accident, if care is used.



Musical bells made from old bottles.

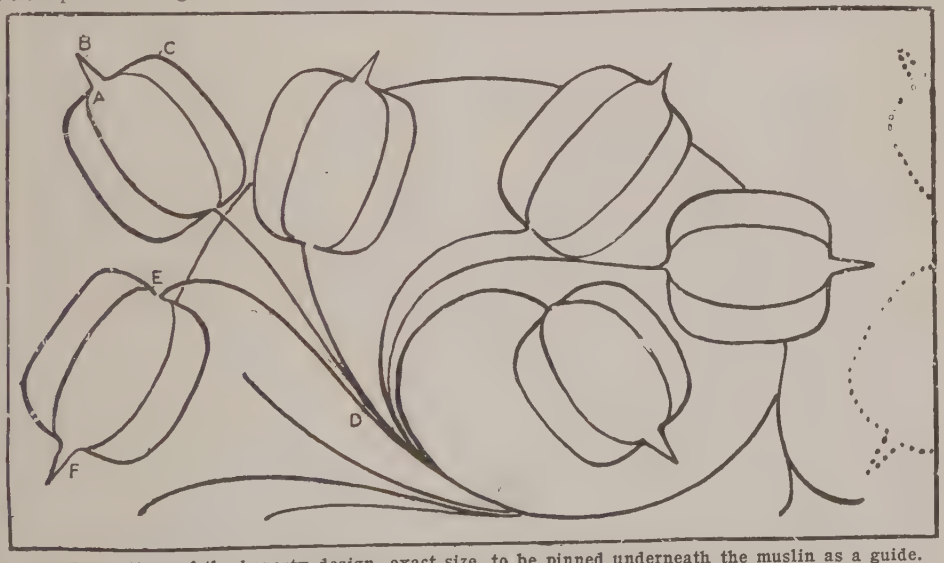
A DAINTY MUSLIN WINDOW-CURTAIN

THE idea illustrated in picture 3 is a charming way of decorating short white cheesecloth curtains, and the wonderful thing about it is that there is no need to have the pattern drawn on to the material, because cheesecloth is transparent enough to be seen through. The pattern, which is drawn on paper, is therefore pinned underneath the material, and the work done on top.

The particular design shown below, which is made from the honesty plant, is a repeating pattern—that is to say, we work one section and shift it along to continue, and the design is arranged to join on neatly, as indicated. The best thread to use is white flax thread—medium fine—which is inexpensive. We should cut it so that long threads are left to work with, and use a medium-sized darning-needle.

We must measure our window, cut the muslin to fit, and make the hem before we begin our pattern, which must be traced on to a sheet of note-paper from the picture, and outlined in ink. With two pins it can be fixed underneath the muslin, on the left side, two inches above the hem.

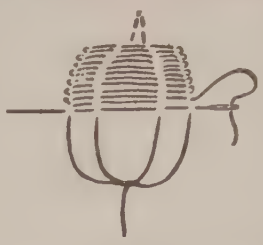
The stitches used are the darning stitch and



1. The pattern of the honesty design, exact size, to be pinned underneath the muslin as a guide.

the ordinary running stitch. The darning stitch is used to fill in shapes. Now to begin: We tie a very tiny knot in the thread, and put the needle in at point *A* in picture 1, behind the cheesecloth; the pattern can be bent for the purpose. We run three stitches to *B*, and three back again to *A*, a long stitch to *C*, and then start darning from side to side of the honesty shape. We take three long stitches on top and two tiny ones underneath, leaving a small loop at each end until the shape is covered and we are down to the stalk. We run down the stalk and up the next one, from *D* to *E* where we begin to darn the next honesty shape, this time working upward. Finish off with a back stitch at the point marked *F*.

This should almost finish the thread, but even if we still have some cotton left we should begin with a new thread at the top of the next shape. Joinings in the middle of a shape must be avoided. We continue like this, running all the stalks and darning the shapes. The paper pattern underneath our work makes it firm, and prevents puckering. We should notice that the two little stitches are always made on the inner lines, which are to help us

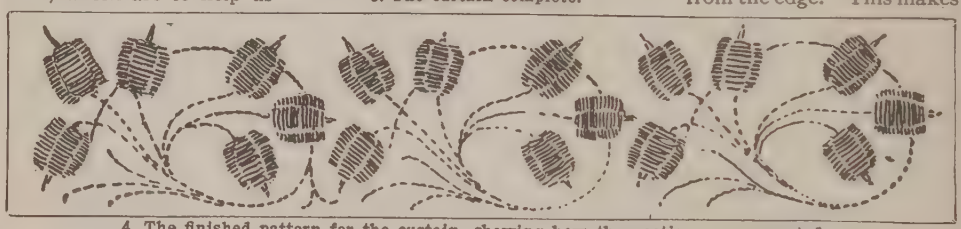


2. The darn.

3. The curtain complete.

off the pattern, this will explain. Buy a sheet of tracing-paper and cut off a piece big enough to cover picture 1. Lay it on top, and go over the whole pattern, which will clearly show through in pencil. Remove it and pin it to a piece of stout note-paper, and then get a piece of carbon-paper and lay that in between. Go over the pattern on the tracing-paper again, and a clear impression from the carbon will be left on the sheet of note-paper below. A charming centrepiece can be made with this pattern by using it as a border all round a square of fine muslin.

It should be finished with a hem 1 inch wide, and backed with a piece of soft pink silk to show up the pattern. Or, if we like, we can make a little pincushion for someone's birthday by repeating the pattern once only, darned on to a piece of muslin cut into an oblong shape measuring 6½ inches by 4½ inches. But instead of darning it in thread we can use embroidery floss in palest pink, costing a few cents a skein. When the darning is done, cut another piece of muslin the same size, for the back, and join these two pieces neatly together by running them round three sides, ½ inch from the edge. This makes the little bag to contain the cushion, and when we have turned it right side out it is quite ready to go on.



4. The finished pattern for the curtain, showing how the sections are repeated.

to keep them straight, and also form part of the pattern.

For those of us who do not know how to trace

TWENTY-FIVE WAYS OF SAYING THE SAME THING

THE following line from Gray's Elegy is probably unique, in that it can be transposed in twenty-five different ways, and yet each time express practically the same thought:

The ploughman homeward plods his weary way
The weary ploughman plods his homeward way
The ploughman, weary, plods his homeward way
His homeward way the weary ploughman plods
His homeward way the ploughman, weary, plods
The weary ploughman homeward plods his way
The ploughman, weary, homeward plods his way
His way the weary ploughman homeward plods
His way the ploughman, weary, homeward plods
His way the ploughman homeward, weary, plods
His homeward weary way the ploughman plods
Weary, the ploughman homeward plods his way
Weary, the ploughman plods his homeward way
Homeward his way the weary ploughman plods
Homeward his way the ploughman, weary, plods
Homeward his weary way the ploughman plods
The ploughman homeward, weary, plods his way
His weary way the ploughman homeward plods
His weary way homeward the ploughman plods
Homeward the ploughman plods his weary way
Homeward the weary ploughman plods his way
The ploughman, weary, his homeward way plods
The ploughman plods his weary homeward way
Weary, the ploughman his homeward way plods
Weary, his homeward way the ploughman plods

GAMES TO PLAY WITH MARBLES

RING-TAW

A CIRCLE about 1 foot wide is drawn on a piece of smooth ground, and in it is placed a number of marbles, one or two from each player. Outside and around this, some 6 feet away, another circle is drawn. The beginner then kneels, with his hand against this outer line, and shoots his playing marble, or taw, at the group placed in the central ring.

This is done by pinching the taw between the knuckle of the bent thumb and the curve of the forefinger and suddenly straightening the thumb. If he knocks any out, they are his, and he may aim again from the spot at which his taw has stopped. If, however, he misses, and his taw remains within either of the rings, he must leave it there, in case the next player wishes to shoot at it. If hit, the owner of the taw must hand over one marble, but no taw can be taken, and it can be aimed at only once. The game continues in this way till all the marbles are knocked out of the ring.

OVAL RING-TAW

THIS is another, though more unusual, way of playing ring-taw. Instead of a circle, a large oval, about 3 feet long and 2 feet wide, is drawn. At each end of this a small space is marked off by a straight line from side to side of the oval, and midway between these two spaces a small cross is made. On this mark a marble is placed, and one in each of the end spaces. A straight line, as long as the oval is wide, is drawn on the ground, at a distance of 4 feet from the end of the oval, and from this line the taws are shot by the players.

The player may shoot from any part of the line, and should choose a position that gives the best chance of hitting one of the three marbles. It is a common practice to lay up—that is, to shoot the taw with little force, so that it rolls into the ring and makes the next aim easier. But as each player shoots in turn, this puts the taw in danger; yet boys are willing to run the risk of having their taws knocked out by others, rather than shoot them through the ring time after time without hitting anything. Though in this game there are fewer marbles to aim at, it is more exciting and interesting than ring-taw.

PITCHSTONE

TWO players with two marbles play this game. One boy throws his marble down. If his companion can hit it with his own, he wins ten points, and has the right to try again, aiming from the spot at which his marble stops. He may keep on till he misses, when the other player takes a turn. A certain number should be fixed upon—say, one hundred—and the player whose points reach this first will be the winner. Sometimes this game is played with smooth pebbles.

PICKING PLUMS

AFTER drawing a long straight line, each player places upon it one or more marbles, all separated from each other by 1 or 2 inches. Then another line is drawn at a distance of 8 feet, and each player takes his turn to shoot once at the "plums." Those he knocks out he is supposed to keep as his own; every time he misses he gives up a marble.

PYRAMIDS

THE pyramid is made by one of the players placing several of his marbles close together in a group and others on top of them. Round this pyramid a little circle is drawn. He then agrees that any of the other players may shoot at it by paying him one marble for every shot. If the aim is successful, the marbles will roll out of the ring and will belong to the boy who knocked down the pyramid. It has to be built up again for the next player. Of course the owner makes his profit out of those who aim without hitting, which very often happens.

WALL MARBLES

TWO players take their stand opposite a wall, against which one of them tosses a marble. When it has rebounded and rolled along the ground the second player follows suit with one of his own marbles, trying to throw it in such a way that in rolling back it will strike the first marble. If successful, he takes up the one so hit as a prize, but leaves the marble he threw where it lies. Under no other circumstance must a marble be picked up until all the marbles of each player have been thrown. Then those lying farthest from the wall may be taken up in turn and tossed against the wall. It requires skill and judgment to play this game.

THE SERPENT

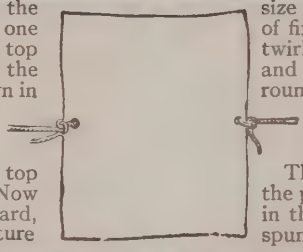
THIS is a game that French boys play. The outline of a serpent is drawn on the ground, with two coils, as the accompanying picture shows. The eye of the serpent is a small hole made in the ground. The players start from the tail, and in turn shoot their taws along between the curved lines. Any who send their marbles outside these lines, or allow them to pause at either of the two points marked *AA*, must go back to the tail. Also, he whose marble is struck by that of another while on the journey to the head must begin again. The boy who first reaches the eye and rolls his taw into the hole is counted the winner.

STAND-UP MEGS

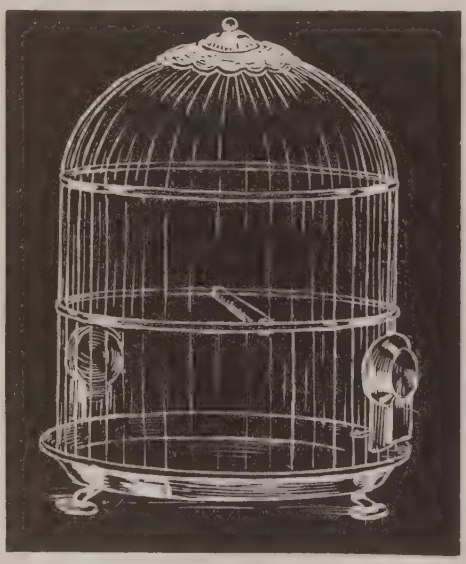
TO play this game we make or draw a 2-foot ring about 8 inches from a fence or wall. A line is drawn about 7 feet long from the centre of the ring, and another line is drawn across the end of this, at which the players take their stand. Any number may play, but from three to six players provide the best game. A large alley is placed in the centre of the circle, and the players take it in turns, in a standing position, to shy at the alley with a taw. If the player misses, he pays a marble to each of the other players; if he hits the alley, he receives a marble from each and goes on shooting until he misses, when it is the next player's turn.

MAKING SPINNING PICTURES

ANY boy or girl can easily make a series of pictures from which a great deal of entertainment may be derived. Cut out a piece of cardboard the exact size of one of the black pictures on this page. On one side of it trace the fish seen in the top picture on the left, keeping it in the exact position on the card as shown in the picture and making all the rest of the card black; on the back of the card trace the grill shown exactly as it is in the top picture on the right side. Now make two pinholes in the card, and fix to each side of the picture a piece of thin string or a piece of thread as seen in the small picture in the middle of the page. This picture, of course, does not represent the size of the card, but only the method of fixing the string or thread. Then twirl the string between the fingers and thumbs and the card will spin round rapidly, making the two pictures blend into one so that the fish will seem to be lying on the grill.



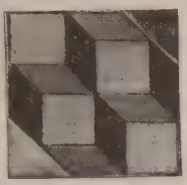
The lower pair of pictures, showing the parrot and the cage, can be made in the same way. When the card is spun, the bird seems to be in the cage.



HINTS AND TRICKS FOR ODD MOMENTS

THE MYSTERIOUS CUBES

HERE is a curious design. Let us look carefully at it, and say whether we can see three cubes with their right-hand sides hidden and their left-hand sides showing black, or three cubes with their left-hand sides hidden and their right-hand sides showing black. In other words, are two cubes resting on one cube, or is one cube resting on two? While we are looking at the picture and trying to answer the questions, we shall probably get very mixed in our minds, for at first the cubes will seem to be in one position and then they will suddenly seem to change their position.



A TOY TO DISGUISE THE VOICE

A SIMPLE little instrument can be made out of a piece of bamboo which will enable us to disguise our voice so that our friends will not recognize it. We take a piece of bamboo about the thickness of a walking-stick, and 3 or 4 inches long, and remove any pith there may be inside. Then we cut a notch at each end, on opposite sides of the bamboo as shown in the picture. Over each end of the bamboo we stretch tightly a piece of thin tracing-paper. Then, with a large pin, we prick a hole in each piece of tracing-paper. The instrument is now ready, and we may begin our experiments upon our friends.

A LITTLE FOUNTAIN IN A JAR

THIS picture shows how we can make a little fountain in an inverted glass jar. Any kind of glass jar will do—one in which we buy pickles or jam, for instance. We take a small bottle about half the height of the jar, and fill it about three-quarters full of water. Then we cork it well with a cork in which we have previously bored a hole. Through the hole we pass a glass tube long enough to reach nearly to the bottom of the bottle. About 1 inch of the tube should project above the cork, and we should seal the cork to the bottle all round with soap or wax, so that no air can get in. In a plate or tray we place several layers of wet blotting-paper, and stand the bottle in the middle. Then we take the glass jar and, warming it well, place it, mouth downward, over the bottle. In a few minutes the air in the jar, which was warm, will get cool and so take up less room, thereupon a small jet of water will at once spurt from the tube of the little bottle.

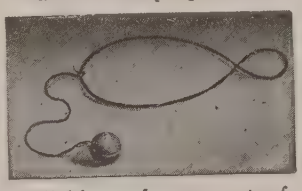
A DIFFICULT DRAWING TRICK

THERE is a drawing trick which seems simple, but is very difficult. Let us take a book or board, and place on it a sheet of paper. Then, holding the board with the paper horizontally, let us stand immediately in front of a looking-glass, and, looking in the glass, try to draw on the paper a square and its diagonals. Of course we must not look at the paper itself or the pencil while drawing, but only at the reflections in the looking-glass. It is surprising how difficult it is to get the lines at the right angles.

After some practice we shall find, however, that if we depend on our brain rather than on the glass we can draw the square. Concentration on the angle at which our wrist is turned is the secret of success. What we see in the looking-glass is just like a street sign—it helps us to decide what we want to do.

A HOMEMADE CUP AND BALL

IT is quite easy to make a toy that will answer the purpose of the well-known cup and ball. We take a piece of wire about 2 feet long, and bend it as shown in the picture. Then we take any ordinary ball, or, if a ball is not available, make one out of anything that is handy, and tie this to the wire with a piece of flexible string about 1½ feet long. The toy is then ready for use, and the game is to hold the wire by the handle, and see how many times we can swing the ball through the loop without letting it touch the wire. Any number of players can join in.



A LEG TRICK

THERE are many simple tricks for boys which seem quite easy to do, but which, when attempted, prove to be anything but easy. Let us put our leg on the table in the manner shown in the picture, taking care that our heel and the back of our knee are both touching the table. And then let us try to untie our shoelace.

HOW TO KEEP A HISTORY NOTEBOOK

WE have from time to time learned much of the world's history. How can we fix in our memories the order in which the nations rose and fell, and marshal the procession of mighty men through the centuries?

Let us take an ordinary notebook and rule a thick, black line down its middle opening. Along the line let us write: Time of the Birth of Christ. Then let us head twenty pages after the line thus: first century A.D., second century A.D., up to twentieth century A.D., each page standing for one hundred years.

Perhaps before going any farther we may like to jot down a few entries in the centuries to which they belong, such as Edward VII, near the beginning of the twentieth century; the opening of the first railway in America before the middle of the nineteenth century; the French Revolution toward the end of the eighteenth; England a commonwealth in the middle of the seventeenth; Spenser, Shakespeare, Francis Drake, the Armada, all in the last quarter of the sixteenth; the departure of the Romans from Britain and the arrival of the English in the fifth; the Conquest of Britain in the first; as well as notices of names and events in the rest of the world.

Next, let us turn to the centuries before Christ and head the pages before the black line, first century B.C., second century B.C., and so on back and back till we come to the fifty-fifth near the beginning of the book. Each page, as before, stands for one hundred years, and, as before, the beginning of each century is at the top of each page, though, as we are dealing with years before Christ, we number from the bottom upward, because time is reckoned backward from the birth of Christ, and 100 B.C. is an earlier date than 1 B.C. If any difficulty is felt about this, we can number a few of the B.C. centuries, taking care that fifty comes about the middle of the page, and seventy-five and twenty-five at the first and last quarters.

Let us fill in a few of the names we know well, passing backward into the mists of time.

We have Julius Cæsar in the middle of the first century B.C.; Alexander in the last quarter of the fourth; the soul-stirring names of Marathon and Thermopylæ in the beginning of the fifth, and so on.

Many of the century pages in the long stretch of years will remain empty of names, even after we have read many books and studied in many museums. From time to time, too, we may have to make changes in our pages, for constantly new finds of old treasures upset dates that have long been thought correct.

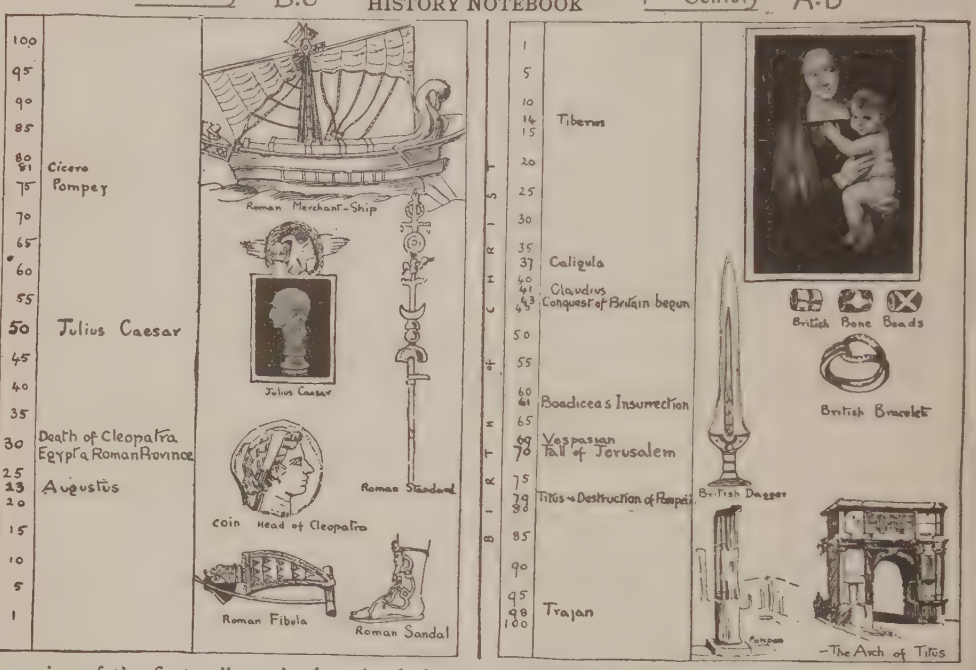
It adds immensely to the interest of our History Notebook if we can illustrate its pages with sketches of our own, drawn from objects in the museums or from pictures.

On the pages after the twentieth century A.D. can be drawn maps of the countries in the different stages of their history, also plans of the great cities, and of the battles of the world at different stages of their progress.

If there are any spare pages at the beginning of the book, we can put in them drawings or photographs of the various prehistoric implements which belong to the distant ages before history came to be recorded in writing.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 6516.

TWO PAGES FROM THE HISTORY NOTEBOOK



TWO POET-SOLDIERS

RUPERT BROOKE, A BRITISH POET

CONTINUED FROM 6295

SACRIFICE is an institution as old as history. Every devout soul erects in his heart an altar, and on this altar he lays, if need be, the best that he has in willing offering, even as Abraham of old, in quick and unquestioning obedience, laid on the altar his son, his only son, whom he loved. This would seem to be God's method of testing quality of soul.

In the early months of the World War there died in the service of his country a young English poet of great promise. He left one volume of verse, and a grave in "some corner of a foreign field" marked "Rupert Brooke."

Rupert Brooke was born in 1887 at Rugby, under the shadow of the ivied turrets where that friend of boys, Dr. Thomas Arnold, was headmaster in the days of Tom Brown—a school which must long be noble because of the memory of that great teacher. In this school the boy's father was an assistant teacher. "What a wonderful world it was to be born into, that little England that was mine, and how it seemed as if the days were not half long enough for one to taste all the joys they brought," he once said, looking back upon his early boyhood. All the things he saw and loved passed swiftly into his being. It is pleasant to think of him in that fair setting of Warwickshire fields under bright skies, with hedgerows all abloom, loving everything that makes the English summer sweet.

Rugby School did its best for this lad of promise. One of the Rugby boys said of him: "Rupert can't be spoiled or he would have been long ago. He never stops to bother about what people say of him. Of course a chap who can play football and carry off school honors at the same time has something better to think about."

From Rugby he went to King's College, Cambridge, where again he made many warm friends and won honors, chief of which was a fellowship which enabled him to continue his studies with extensive travel on the Continent. In addition to having been born a gentleman, these seem to have been his chief life-assets: sound scholarship, a keen intelligence, a character well knit, a rare physical comeliness, a gift of words, a poetic habit of mind, a sense of humor and an overpowering personality. He was, in short, a rare specimen of youthful manhood. We may not agree with Henry James the novelist, who said of him: "Anyone who can give such all-around satisfaction as a human being, should not be encouraged to specialize. Surely one who can *be* so much that makes life worth while

for everyone who knows him, ought not to have to struggle to do things." The world can hardly be sorry that Rupert Brooke loved work even as he loved so many other good things, and that the work he chose was that of a poet. Already in his college days he had produced some notable verse—verse remarkable not so much for sustained excellence as for frequent brilliant passages. He was not a great poet, but to become one seemed to be within his easy reach. We see him as a radiant youth mounting the hill of promise and standing at the doorway of attainment.

But there came the call to arms. He said grimly: "Well, if Armageddon's on, I suppose one should be there." To him, as to so many others, the outbreak of so relentless a war seemed to be the mysterious Armageddon foreshadowed in the Book of Revelation as the war of wars, when the "kings of the earth and the whole world" should gather for battle.

The first weeks of the war saw him in the trenches, in the futile defense of Antwerp. The terrors of war and the suffering which he saw raised him to new heights of manhood. This young poet-soldier, marching in night-retreat under a black sky, lighted only by the fitful glare of burning villages, saw the pathetic multitude of homeless fugitives filing eastward to uncertain welcome. He saw two small children trying to help their mother push a wheelbarrow piled with clothing on which sat the feeble, trembling grandmother; another family with their rescued belongings on a milk-cart pulled by a panting dog and pushed by a small heavy-eyed lad who watched to see that nothing dropped by the way; aged peasants with bundles on their backs; sad-faced mothers wearily carrying babies and trying to cheer frightened children clinging to their skirts, all with the dazed look of those who flee from fire and flood, from all they knew as home into outer strangeness.

The following February he joined the hapless expedition to the Dardanelles. From no feeling of cowardice or morbidness he seemed to feel the approach of death, "Death with shadowy and relentless feet." But he went

> With unreluctant tread,
> Rose-crowned into the darkness.

He died aboard a hospital ship in the Mediterranean. His comrades bore his body a mile inland at night by torch-light, and buried it on the heights in an olive grove on the isle of Scyros on the twenty-third of April. A short time before, he had written the sonnet which you may read on page 4273.

The best for the sacrifice—his life, his genius, his all! But as a brother-poet sings,

> Fling yourself in the fire,
> Die with a song of spring,
> If die you must in the spring!

Is it not of such stuff that victory is made?

JOYCE KILMER, AN AMERICAN POET

IF there was any one thing that distinguished Joyce Kilmer, aside from the genius he so surely possessed, it was a great enthusiasm and zest for living and doing things. It was this energy which enabled him to crowd into his short life such an immense amount of experience and accomplishment. He lived such a busy life that no one knew just how many offices he held, how much work he did, and often after a hard day he would spend half the night dictating to his secretary or to his wife, sometimes walking up and down the room with his baby on his arm at the same time. He seemed to grow older than his years, and treated his co-workers, even men much older than himself, as if they were younger, calling them "children." Indeed, many men who lived twice as many years as this young poet did not attain his knowledge of life.

Joyce Kilmer was born in New Brunswick, New Jersey, December 6, 1886. He graduated from Rutgers College in 1904 and received the degree of Bachelor of Arts from Columbia in 1906. As a student he did not shine, but was merely an average boy with a great interest in the college journals. Shortly after graduation he was married and taught Latin in high school, but about a year of teaching was sufficient to prove that that was not his field, and he went to New York, taking his wife and infant son. In quick succession he became the editor of a journal for horsemen, salesman in a bookstore and assistant editor in preparing a new edition of the Standard Dictionary.

His energy on this last work was rewarded by rapid promotion, and in his assignments to verify dates, origins of customs and the like he made many acquaintances—people of all kinds and in all walks of life—and he found them all exciting and fascinating, as they found him charming and original.

In 1912 he was employed as reviewer on The New York Times Review, and a little later became a special writer on The New York Times Sunday Magazine. He was delighted to be a newspaper-man—a "hard newspaper-man," he called himself. Each article he wrote showed a quality that could not be denied, and through it his young, pure, eager spirit shone. Everything that came to Joyce Kilmer, whether work, sorrow or joy, he met with interest and found it valuable experience.

On his way home from an interview Kilmer was hit by a train and taken to the hospital with three fractured ribs. After wiring for his secretary and dictating the interview, he settled down to enjoy his experience: "One isn't hit by a train every day!"

In 1913 appeared a book of poems which contained the famous Trees, which you may read on page 4271. If there had been no other fruit of Joyce Kilmer's life, this one poem would suffice to give him a cherished place in the heart of humanity. In this spirit of nearness to God he reached the sublime heights and lost himself completely in the ideal of his poem.

As his friends in the literary world began to know him better they saw in him more than a clever boy. He was a young man with the knowledge of one much older, with unlimited capacity for work, and with a look in his eyes which made a well-known writer say of him that he had a "hint of destiny": "We have all met young people who give us that—beautiful, brilliant, lovely-natured, so supernatural, and touched, too, with the finger of a moonlight that has written 'fated' upon their brows."

In the midst of this busy life the news came that the United States had entered the World War. It would have been surprising if Joyce Kilmer had not been a fighter: he was always ready to go to battle in a just cause. And now, "one fight more, the best and the last." And so it proved. Three weeks after the declaration of war he enlisted in the 7th Regiment National Guard, New York, but a little later was transferred, at his own request, to the 69th, the famous "Rainbow Division."

When he reached France he wrote back with his usual enthusiasm that this was "the pleasantest war I have ever attended." He liked the country, the people and the war. He learned to sing the soldiers' songs and liked them, and was very proud of himself for learning all the little things a soldier has to know in war time.

Indifferent to any danger, he would crawl, without orders, through the barbed wires at night trying to locate the enemy; and in the morning he would be found applying to his superior officer for a new uniform.

On July 30, 1918, the battalion in which Joyce Kilmer served was not in the lead, and he offered his services to the major of the foremost battalion. In the fighting that day he met Death. We feel no doubt that he went to that last meeting with all the eagerness and interest which characterized all his undertakings. Death had no terror for him, for he knew that beyond lay life in all its fullness.

THE HERO OF KAVALA

KAVALA, which is a seaport on the coast of the Ægean Sea, had been captured by the Bulgarians. When disaster fell upon the Bulgarians they were afraid their army might be surrounded if they maintained their position, and so withdrew the bulk of it, leaving the fortress in the keeping of two hundred men. These men were to burn the town so that it might not fall into the hands of the enemy.

News of the decision reached the horrified inhabitants. They learned that the soldiers were collecting stores of petroleum; they heard them sharpening their bayonets, saw them loading their guns. The poor people shut themselves in their houses, expected death, and prayed for life.

Only one man did not give up hope. A Turkish fisherman looked out across the waters and saw the island of Thasos,

eighteen miles across the sea. There lay the Greek fleet, and Greece was at war with Bulgaria. So when the sun went down and only the pale stars lighted the way across the waters, the brave boatman, creeping in the shadows past the sentries, stole down to the beach, launched his boat and stole out of the bay, through the searchlights which lighted up the waters around about him. His safe escape seemed miraculous. It was, he said, as if a great hand were stretched above him to hide him from the lights.

With a beating heart and straining muscles he set out to row the eighteen miles to Thasos. Early in the morning he reached the island, glided in among the Greek warships, and cried out to a battleship: "For the love of Allah and for the love of your God come quick, for at sunrise the Bulgars sack Kavala."

The answer was immediate. A Greek gunboat got up steam and set out swiftly for Kavala. As the sun climbed up above the horizon the people of the town heard a cry from a watcher on the shore: "The fleet! The Greek fleet!"

Then the inhabitants of Kavala knew that they were saved, for with the Greeks there the Bulgarians would not attempt to sack the town.

Doors and windows were flung open. The people rushed with joy into the streets and down to the shore, and as the captain of the ship that had come to save them stepped ashore they seized him in their arms and carried him shoulder-high at the head of a procession of sailors.

At the back of these stalked a figure in a red fez, stumping stolidly along and nodding contentedly. It was the valiant Turkish fisherman who had rowed to Thasos and brought back the Greek fleet to save the town.

EDITH CAVELL

IN war time, when people make great sacrifices for their own country, one who lays down his or her life for all humanity, friend or foe, deserves universal and lasting admiration. The heroism of Edith Cavell, an English nurse, will never be forgotten by those who lived through the World War.

To her, in Belgium in the World War, it mattered nothing whether she was nursing friend or foe. She was the friend of all who needed her, and even Germans she nursed back to health. But one thing this brave woman could not bear: she could not bear to see the German army forcing Belgians to work against their country. She could not bear to see these men enslaved by German conquerors. And so she sheltered them and helped them to escape to Holland or to France. She risked her liberty in doing so, and one day the Germans found her out, found her guilty of being kind to suffering people; and for this they sentenced her, not to a short imprisonment, not even to penal servitude, but to death "in the interests of the State."

The ambassadors of other nations appealed in vain against this savage sentence, and in the early morning of October 11, 1915, a German firing party took Edith Cavell to a garden, where an officer took a pistol from his belt and shot her dead.

She died like a daughter of England. Too proud to feel the scorn of her enemies, too noble to hate them, she left this message, which will ring forever down the corridors of time:

> Standing as I do in view of God and Eternity, I realize that patriotism is not enough. I must have no hatred or bitterness towards anyone.

With this noble farewell to the world Edith Cavell reached the gate of heaven.

Her woman's heart, burning with brave design,
Forgot the law, and when a man desired
To play the man, her woman's soul was fired
To help him join again his country's battle line.

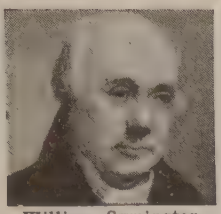
For that she died; the hands that she had healed
Took her rare life; the heads that she had bound
Plotted the giving of her own death wound.
Not womanhood could save; not womanhood could shield.

. . . . . .

Her woman's gentle voice above this strife
Wakes echo from the secret, golden bell
Called conscience, so that time to come shall tell
How that most honored death helped men to nobler life.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 6879.

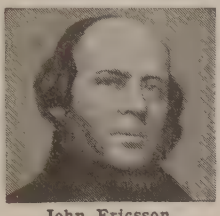
Isambard K. Brunel.

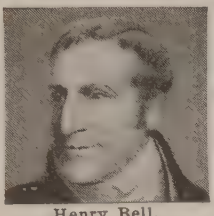

William Symington.

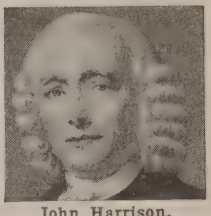
Robert Fulton.

Sir C. A. Parsons.

Jonathan Hulls.


John Ericsson.


Henry Bell.


John Harrison.

CONQUERORS OF THE SEA

CONTINUED FROM 6332

IN reading the adventures of Robinson Crusoe we all feel thankful on coming to the part where he is saved from the sea. But when he settles down on his island, gloom at first comes upon us, for there he is in that desert spot, alone, surrounded by the sea. It is a dreadful position for a human being—so lonely, so hopeless.

With no ships the sea would be a source of horror to us. It would be a fearful void, shutting us off from communication with other parts of the world. And that is just what the sea was to men before they learned the art of shipbuilding and navigation.

We read on page 3909 the story of the beginning of shipbuilding and its progress until the clipper ships made such rapid voyages across the seas. Now we shall read about iron ships, driven by engines instead of sails, and the men who made them. The ocean became a roadway leading to all parts of the world. Storm and tempest, fogs and hidden rocks still cause disaster, it is true, but the accidents are rare, considering the enormous number of ships there are. The sea has become one of our best friends.

And all this wonderful change in our affairs we owe to a very small number of men. It will be enough for our purpose if we glance briefly at the careers of the chief figures in these revolutions in the history of the world.

Every time that some great change has been proposed for the benefit of mankind people with power and influence, who ought to have given their encouragement and support, have always been among the first to say: "It can't be done," and "It shan't be done." That is just what happened concerning the steamship and the ocean telegraph. Take first the steamship. No invention ever had a harder struggle for life. Fate and men both seemed against it.

THE MAN WHO FIRST MADE A MACHINE DRIVE A BOAT THROUGH WATER

The Spaniards say that a countryman of theirs named Blasco de Gary, who lived in the sixteenth century, made a model steamboat in 1543. But we have to be careful about believing stories of this sort without clear proof. It is almost certain that though the boat had paddle wheels, they were not worked by steam.

A century later Denis Papin, a famous Frenchman, appeared on the scene. He was a physician, born at Blois

in 1647, and he died in England about 1712. A very talented man, he was associated with several of the famous men of whom we have read in the story of the men who found electricity, told on page 1243. His name is found among those of inventors of the steam engine, although he did not accomplish the making of a true steam engine as we know it. His was the first engine with a piston.

He worked out a simple way for condensing the steam in the cylinder under the piston so as to leave a vacuum there, and he invented the safety valve. What he invented was an engine worked not really by expanding steam, but by atmospheric pressure. His idea was a brilliant one, and it led to great things in the hands of Newcomen, Brindley and Smeaton. We must remember that it was not the true steam engine; but as his engine, such as it was, was fitted to a model boat and drove the boat through the water, Papin well deserves his place in the gallery of inventors who brought about steam navigation.

TWO GREAT INVENTORS WHO WERE RUINED BY THE FRENCH REVOLUTION

Many names appear for a little time upon the page of the history of this invention. One of them, Jonathan Hulls, patented a sort of steamboat in England in 1736, but years were to pass before anything practical was done. More men crowded to the task, and we find several skilled inventors working in rivalry at the same time. One of these was the unfortunate Marquis de Jouffroy, who, born in France in 1751, set himself, at twenty-six, the task of driving a boat by steam. He adopted Papin's idea, and in eight years made three successful boats. The first was forty feet in length; but it was the third which is said to have been the first real steamboat. Jouffroy might have gone on to complete success, but the French Revolution drove him, an exile from his country, to America. When he returned to France he was too late: others had seized his ideas and begun to reap the honors which should have been his. He died in 1832.

At about this time two American engineers named James Rumsey and John Fitch were making experiments. Rumsey is of importance to us as being the man who first turned the attention of Robert Fulton to the subject. Fitch came into prominence in the American Revolution, acting as gunsmith in the Revolutionary army. His first model steamship was made in 1785. The next year he built another boat with paddle wheels, and in 1790 one of his boats carried passengers on the Delaware. He went to France just as Jouffroy was leaving, and, like Jouffroy, was ruined by the Revolution. It is said that while he was there his plans were shown to Fulton. At all events he returned to America, starving, and killed himself.

THE PAINTER OF PORTRAITS WHO BUILT A STEAMBOAT

It was for something quite different from shipbuilding that Robert Fulton went to England. He was a painter of portraits, born in Pennsylvania in 1765. He set out for England in 1786 in order that he might study this art under Sir Benjamin West. He became acquainted with Rumsey, who had gone to England earlier, and, after discussing inventions with him, gave up all thought of painting. Fulton's brain teemed with ideas. He invented devices for the improvement of canals, for cutting and polishing marble, for twisting rope, for iron bridges, for spinning flax, for dredging rivers, and for making boats go under water and blow up ships. But the great work of his life was done for the steamship.

In 1803 he built a steamship, but its engine was so heavy that it fell through the bottom of the vessel into the river Seine, in France, where he was trying it. He did not lose heart, but recovered the engine and built it into a stronger boat. This he made to move, but it was too slow to be successful. Going back to England, he prepared plans and had an engine built by Boulton and Watt, of whom we have read on page 990. Then he came to America and left the engine to be brought over, packed up in a ship. When it arrived he set to work to put it together. His story, told in his own words, gives us an excellent idea of the hard lot of the inventor of those times.

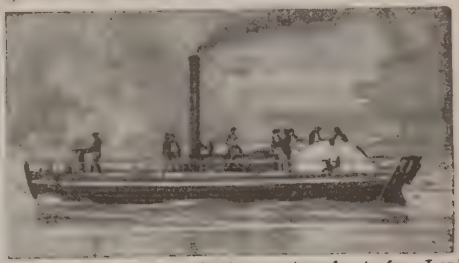
ROBERT FULTON'S FIRST STEAMER, AND THE SCOFFING OF STUPID MEN

"When I was building my first steamer in New York," he wrote, "the work was viewed by the public either with carelessness or contempt, as a useless scheme. My friends, indeed, were civil, but they were shy. As I had occasion to pass daily to and from the building yard while my boat was in progress, I often loitered

THE FIRST STEAMBOATS EVER MADE

Although the honor of building the first steam-propelled vessel has been claimed for several different men, yet it probably was an Englishman named Jonathan Hulls who built the first steamboat, in the year 1736. Here we see Hulls' own drawings of his vessel, which are still in existence in the patent office.

One of the very early steamboats was built by a Scotsman, William Symington, in 1788. It had two paddle wheels right in the middle of the deck.



In 1803 Symington built a steamboat for Lord Dundas, and it towed barges on the Forth and Clyde Canal until its use was forbidden.

An American inventor, Robert Fulton, was the first to make steam navigation commercially successful, when in 1807 he launched the Clermont.

Another success was by a Scotsman, Henry Bell, who built this ship called the Comet in 1812. It scared ignorant people, who thought it a monster.

Inventors were now busy improving the steamboat, and steamers began to be built everywhere. When steamboats appeared on the Thames there was much opposition from the boatmen. By 1837, however, steamboats ran regularly from London to Margate. Here are two steamers approaching Margate Pier.

unknown near idle groups of strangers, and heard them scoff and sneer and ridicule. Never did a single encouraging remark, a bright hope, a warm wish cross my path. My work was always spoken of as Fulton's Folly."

But at last the ship was built, and set out with passengers for a trial trip. The Clermont moved off, went a little way, then stopped. Everybody except Fulton thought that this was the end—that he had failed, as they all had expected. But he went below and soon put right some trifling mishap, and the boat steamed away, while people were saying: "I told you it would be so; a foolish scheme; I wish we were safely out of it." The vessel went its way, a journey of 150 miles in 32 hours. Fulton was delighted, but though the return trip to New York was made in two hours' less time, his friends still doubted, and thought that it could never make another trip. Naturally he felt discouraged. He himself wondered if such a voyage could be repeated, and, if it could, whether it was of any value.

WHY ONE OF THE EARLY STEAMBOATS WAS ALLOWED TO FALL TO PIECES

Fulton was the first man, therefore, to make steam navigation what we call a commercial success. Fitch had shown that something of the sort could be done, but Fulton profited by Fitch's experience and by that of Jouffroy. He died in 1815, but not until he had built several other boats.

Fulton's successful steamer was launched in 1807. Nineteen years earlier a successful steamer had been launched in Scotland, but this was not a commercial success. It was built by William Symington, a Scottish mechanic who was born in 1763 and died in 1831. He first of all built a steam engine to run on the roads, then carried out the building of the steamship for a thoughtful Scotsman named Patrick Miller. Symington's vessel for Miller was succeeded by another which he built for Lord Dundas. It was launched on the Forth and Clyde Canal, and without any trouble towed two barges weighing together 140 tons a distance of 20 miles against a powerful wind. This was still five years earlier than Fulton's success. But what happened? The owners of the canal said that the steamer would create such a current that it would wash away the banks of the canal, and so this fine steamer was run aground and allowed slowly to fall to pieces on the bank of the canal. Fulton saw this vessel, and doubtless gained a hint or two from it.

A POOR MAN WHO CONFOUNDED THE WISDOM OF THE WISE

But Symington's work was not all wasted. One of the men employed in making the woodwork of his first vessel was Henry Bell, the son of poor Scottish parents. Born in 1767, he followed first one trade and then another, and seemed unlikely to do any good, until he was brought face to face with the problems which the luckless Symington was trying to solve. Symington's experiments convinced Bell that success might yet be gained with steam vessels, and for the next thirteen years he gave all his thoughts to the plan.

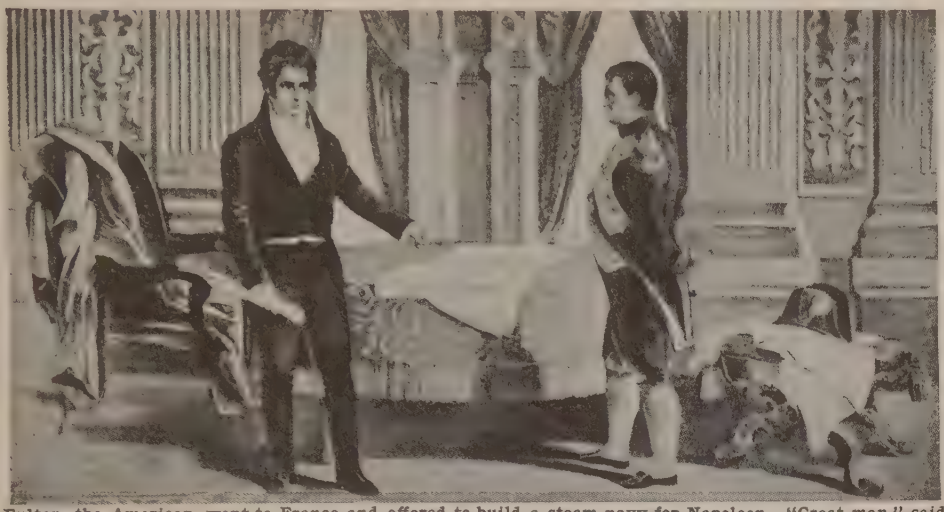
We hear of him in 1800 trying to make the British Government believe in the possibility of the scheme, but he was unsuccessful. How could he hope to succeed in official circles when one of the greatest and best men of the day—Sir Joseph Banks, president of the Royal Society—could say to all the proposals for vessels driven by steam engines: "A very pretty plan, but there is just one point overlooked—that the steam engine requires a firm basis on which to work." Talented man though he was, Banks himself overlooked one point, that even though it floats on water, the hull of a ship does give the firm basis the steam engine requires. Bell gave up hope of encouragement from the Government, and when he had managed to get some money, he set to work in 1811 and had a little steamship of his own built on the Clyde.

SCOTTISH INVENTORS AND ENGINEERS LED THE WAY WITH STEAMBOATS

The ship was called the Comet, and was launched in January, 1812, beginning at once to carry goods and passengers on the Clyde. Great was the terror that it created among ignorant people. They thought, as they saw it puffing along, snorting sparks and smoke, and going against the wind and the tide, that it was some evil monster. When it approached the shore to pull up they ran away and hid themselves.

News of the Comet's success soon spread abroad, and in the year 1813 the first of the Thames steamers was run by a man named Dawson, while a courageous

HOW NAPOLEON LOST STEAM POWER



Fulton, the American, went to France and offered to build a steam navy for Napoleon. "Great man," said Fulton, "if you will support me, you can have the most powerful navy in the world." But French scientists said that steam would not drive a toy. Napoleon was in Elba when he first saw a steamboat.

Fulton also invented for Napoleon a submarine boat, and, with three friends, he remained under water for one hour. This boat was to fire a torpedo, or, as Fulton called it, "a carcase of gunpowder." Nothing came of the invention, and here we see a caricature of the submarine, published in America in 1811.

A great step forward was taken when men learned to drive a boat by a propeller at the end instead of by paddle wheels at the sides. Both methods had their supporters, and in 1845 there was a great test, resulting in a triumph for the propeller. Two steamships, the Rattler, the first warship with a propeller, and the Alecto, a paddle-boat, had a tug-of-war, as shown here, and the Rattler pulled the Alecto quite easily.

Upper and middle photographs copyrighted by The Century Company.

man named Lawrence, of Bristol, sent up a steamer from his native city to carry the people of London up and down their great river. The opposition of the Thames boatmen proved too much for Lawrence, and his vessel had to return to the river Severn. But the steamship industry was now fairly founded in spite of the "wise" men and the Government; and many ships were built on the Clyde to run between Glasgow and Liverpool and other ports.

The success of the Glasgow-to-Belfast boat in 1818 was important because this was the first ship to go out from the coast regularly, making a port in another island its goal. The owner of the Rob Roy, as it was called, was David Napier, a first-rate engineer of Glasgow. It was built by William Denny, of Glasgow, from whose works came several other steamers which set the world wondering.

THE FIRST CROSSING OF THE ATLANTIC OCEAN BY STEAM AND SAILS

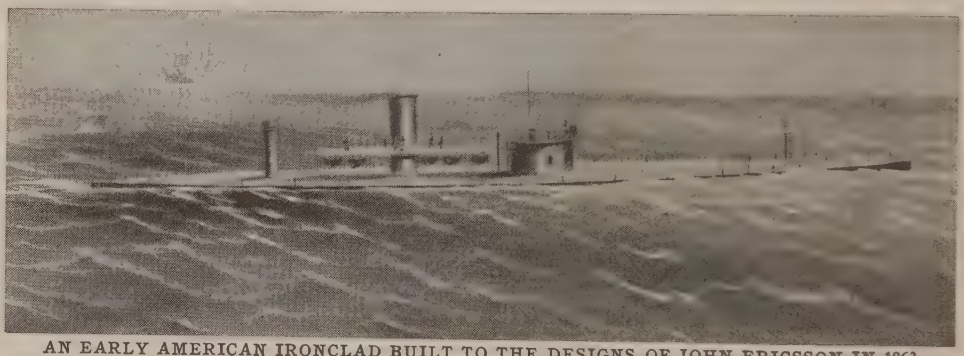
James Watt, whom we met on page 1612, played an important part in the development, his steam engines being largely employed. He was one of the first men to cross from England to the Continent by the new method, a steamship taking him to France in 1817.

From this time forth there was no more opposition to the steamship as a means of sea passage. The next important step was its first voyage across the Atlantic. This was made by an American ship called the Savannah, but she did not steam all the way. She was built as a sailing ship by Francis Fickett, of New York, in 1818; but it was decided afterward to fit her up with a steam engine. This was done, and she set sail for England from Savannah on May 24, 1819, reaching Liverpool 25 days after.

The greater part of the distance had been covered by the help of sails, steam having been used during eighteen days. The Savannah returned to the United States and was not considered useful, for her engine was taken out and she depended, until she was wrecked, upon her sails. Therefore, although the United States claims to have sent the first steamship across the Atlantic, we must remember that she sailed for the greater part of the voyage, and steamed only a little now and then, about one hour's steaming for eight hours' sailing. Six years afterward an English yacht named the Falcon went by sails and steam to India.

HOW THREE REAL STEAMSHIPS CROSSED THE ATLANTIC

The first crossing of the Atlantic by a real steamship was completed in 1833,



AN EARLY AMERICAN IRONCLAD BUILT TO THE DESIGNS OF JOHN ERICSSON IN 1863

when the Canadian ship, the Royal William, steamed from Quebec to London. In 1838, on the same day, two English vessels steamed into New York. They were the Great Western—a steamship built by Sir Isambard Kingdom Brunel, whom we have already met on page 1618—and a smaller vessel called the Sirius. The Sirius had started from England three days ahead of the Great Western, but the Great Western, being bigger and stronger, nearly caught up with her, and the Sirius reached New York only a few hours ahead. The journey had taken the Sirius 17 days, and the Great Western only 14, instead of the month, which a sailing ship required.

The greatest improvement after the actual invention of the steamship was the substitution of a screw propeller for the paddle wheels, and this we owe to Captain John Ericsson, an engineer officer in the Swedish army who settled in England and afterward went to America. His in-

THE COMING OF THE GREAT STEAMSHIP

The Americans claim the honor of sending the first steamship across the Atlantic. The Savannah, shown in this picture, was fitted with engines, and crossed the Atlantic in 1819 in 25 days, but used her sails most of the way.

The Royal William, built in Canada, was the first vessel to cross the Atlantic by steam power, in 1833. A tablet in honor of the men by "whose enterprise, courage and skill" the feat was accomplished is in the Parliament buildings in Ottawa.

When the Great Eastern was launched at Millwall, London, in 1857, it was the wonder of the world, and no one thought such a monster could be surpassed. Its length was 680 feet, and the engines were 1,000 horse power. This ship cost nearly $5,000,000, but it was always having accidents. Its only good work was to lay the Atlantic cable. The Great Eastern had both paddle wheels and a propeller.

The Great Eastern has now been left far behind in size. The mammoth liners of to-day, like the Mauretania and the Leviathan, are much larger than the Great Eastern, and their engines are many times more powerful. In this picture we see the Mauretania leaving the river Tyne, where she was built in 1907.

Photo, Thompson & Lee.

vention brought about a complete revolution in steam navigation.

Ericsson was a clever engineer and built the Novelty locomotive to compete with George Stephenson's Rocket. In 1836 he fitted a boat with a screw propeller and drove it on the Thames, but not receiving the encouragement he expected from the British Admiralty, he went a year or two later to the United States, where he lived for the rest of his life and carried on his ship experiments.

A screw-propelled warship, the Princeton, which he built for the American Government, was the pioneer of the screw steamers of to-day. In 1861 Ericsson designed the ironclad Monitor, which sank the Confederate ironclad Merrimac and changed the whole course of the Civil War. In England the screw propeller was greatly improved by Sir Francis Smith, who in 1839 built the Archimedes, a vessel much larger and more powerful than Ericsson's boat, and he convinced most experts of the practical superiority of the screw propeller.

There was a long fight between rival sides to get the screw propeller used for driving ships, instead of the old wheels at the sides called paddle wheels; but in the end the screw won for all but smooth waters. Similar doubt had to be overcome before the iron ship was built to take the place of wood.

Still later there has come another change in the method of driving the ship. The new plan is called the steam turbine. Many people have tried to perfect an engine on these lines, but Sir Charles A. Parsons, a very clever Englishman, has been most successful. With his new method of driving a vessel we have bigger steamers than ever. The Majestic of the White Star Line is 956 feet long, with a beam of 100 feet and a displacement of 64,000 tons. She has turbine engines of 100,000 horse power and her usual speed is 25 knots an hour. She can carry over 4,000 passengers. She has made the run between New York and Cherbourg in 5 days 5 hours and 21 minutes.

JOHN HARRISON AND THE WONDERFUL CLOCKS HE MADE FOR SHIPS

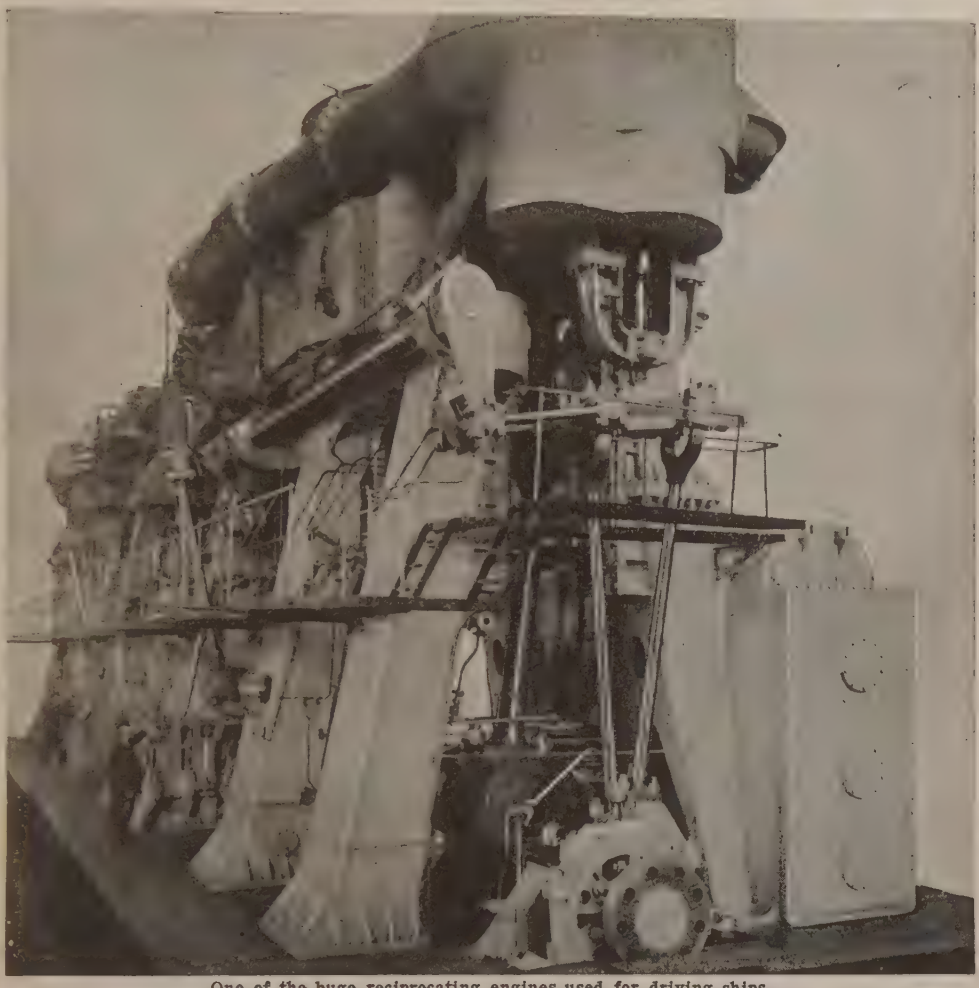
While thinking of the men who actually invented and improved the steamship we must not forget to pay a tribute to another man without whose invention safe and accurate navigation by fast steam vessels would be impossible.

John Harrison at work on his clocks.

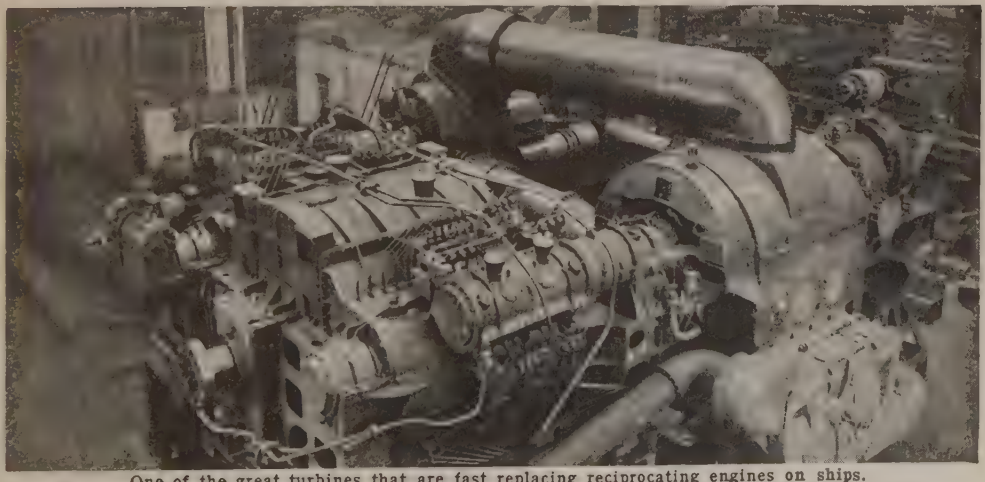
John Harrison, the inventor of the chronometer, was the son of a carpenter of Foulby, in Yorkshire, and as a boy was greatly interested in wheels and all kinds of machinery. He made many experiments with clocks, and in 1715, when he was twenty-two, built an eight-day clock entirely of wood. This clock still exists in London and is kept going regularly. He made many improvements in clock mechanism to insure greater accuracy, and won a prize from the Board of Longitude which had offered rewards varying from $50,000 to $100,000 to anyone who discovered a method of determining longitude at sea within 60, 40 and 30 miles. Harrison made a chronometer—really a large watch fitted with various contrivances to increase accuracy—which did far more than the Board of Longitude had asked. Yet for years he was deprived of his reward, and it was only after Parliament and the king had intervened that he received his due.

Four of Harrison's earliest chronometers are preserved at the Royal Observa-

THE HEART OF A BIG SHIP



One of the huge reciprocating engines used for driving ships.



One of the great turbines that are fast replacing reciprocating engines on ships.

These pictures are reproduced by courtesy of the Fairfield Shipbuilding and Engineering Company.

tory, Greenwich. The principle by which their accuracy is insured is still the principle of the chronometer to-day, although, of course, many improvements have been made. His name is little known, yet navigation owes as much to him as to any other man.

THE MAN WHO INVENTED THE DIESEL ENGINE

In these later days, what are called internal-combustion engines are used in large numbers of small seagoing boats, and even in vessels large enough to cross the ocean. These engines need no boilers to make steam, and no furnaces in which heat can be created, and of course need much less space than steam engines. It is a little difficult to describe their working because they burn their fuel within their own mechanism. But it is not difficult to understand if we remember that they work on much the same principle as the engines of the launches and motor cars with which we are so familiar.

Gasoline, however, is much too expensive to use in the powerful engines required to move some of the larger ships, and in these ships are used engines called Diesel engines, which will burn cheap, heavy oil. In some of these engines changes have been made, and then they are called semi-Diesel engines. Diesel engines are named for their inventor, Rudolf Diesel, a German, who was born in Paris in 1867 and was educated partly in England and partly in Munich. He hoped that his engine would be adopted on most of the large ocean-going ships. Though this has not yet been done, the day may come when steam-driven vessels will be a thing of the past and oil-burning engines, or electricity generated by them, will drive all our ships.

Even now oil is used to make steam for many ships. Some battleships burn oil in their furnaces; the tank ships which carry oil from the oil wells of the United States and Mexico to Europe burn up their own freight. These large vessels are steamships, and the oil is broken, by the force of steam, into spray, so that it will burn in furnaces underneath the boilers.

Diesel is the last of the men whom we can name among the conquerors of the sea, but we must remember that many are forgotten, or little known, who are worthy of remembrance on this roll of honor.

Among the largest motor ships yet built is the Aorangi, equipped with four sets of Diesel engines. The Aorangi is 600 feet in length, 72 feet wide and has a displacement of 23,000 tons. She can make from 17 to 18 knots an hour easily. The Aorangi went into regular service between Australia and Vancouver at the beginning of 1925.

FORGOTTEN CONQUERORS OF THE SEA

The men who invented the self-righting lifeboat, and the curious air-filled liferafts, which some of us have seen and wondered at on board a large vessel, well deserve to be termed conquerors of the sea. Many lives that in times of shipwreck and of warfare would otherwise have been lost have been saved by the use of these wonderful boats and rafts.

Then, too, we ought to remember the builders of the sturdy seagoing tugs which one writer says will tow anything that will float.

If a steamship goes aground in a storm or fog, tugs rush to the place to pull her off, or to rescue the passengers and crew, and if possible save the cargo. Many a good ship, especially on the stormy rock-bound coast of the Pacific, has owed her life, and the safety of all on board, to the work of the tug boats.

Tugs sometimes go on long voyages. For instance, the Dewey dock, which was built in Maryland, was taken by tugs all the way around South America by way of the Straits of Magellan to the Philippine Islands. Another large floating dry dock was towed from the river Tyne, in Scotland, to Callao, in Peru, by two large tugs.

The conquest of the sea was begun by the first man who found that he could float in the water on a log, and paddle himself along with the aid of a broken bough, and the man who invented a skin boat and learned to make a paddle to push it through the water made a long step forward. Our beautiful canoes, rowboats and launches, our staunch fishing boats and graceful yachts, the freight boats that carry thousands of tons of merchandise, the spacious ocean liners, little torpedo boats and giant warships and their inventors and builders are all descended from that first crude little boat, and its savage maker in the far off primitive days.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6509.

THE SAUCY BUT USEFUL TUGS OF THE HARBOR

A great ship is seldom allowed to go in or out of the slip under its own power. It can neither start, turn nor stop quickly enough, and would smash everything that came in the way. Smart little tugs pull and push until the ship is either safe in the slip or is out in open water. This is the Lusitania in New York, shortly before the trip upon which it was sunk by German torpedoes off the coast of Ireland. It seems impossible that the tiny tugs should be able to move such a mass.

6407

QUEENS OF TWO OCEANS

Against the background of lower Manhattan Island the steamship Majestic is seen in our picture. She is 956 feet long and 100 broad. She has 9 decks, and 1,346 staterooms, accommodating 4,000 passengers. Her turbine engines are of 100,000 horse power.

Photo, courtesy Marine Engineering and Shipping Age. Model owned by Edward Lewis, Vancouver, B. C.

The Royal Mail packet Aorangi, which is shown in this picture, is one of the world's largest motor ships. She is 600 feet long and makes from 17 to 18 miles an hour. She can carry 550 passengers. At the beginning of 1925 she entered the regular Pacific service between Australia and Vancouver, Canada.

Photo, Publishers Photo Service.

A view of the River Rhine, with the Rheinfels ruin in the foreground.

THE LITERATURE OF GERMANY

PART II

CONTINUED FROM 6271

IN the last chapter we told you of the early beginnings and development of German literature. Here we are about to read of three of the greatest German writers—Goethe, Schiller and Heine. One might as well omit Chaucer, Shakespeare and Milton as pass over these three among the German authors.

First we must speak of a famous Austrian writer, Franz Grillparzer, who was born in 1791 at Vienna. Quite early in life he felt a desire to write. It was not so much ambition as the desire to express his thoughts and feelings that prompted him. He was a very nervous boy, but when he decided to do anything he usually accomplished his purpose. Working in a government office in Vienna during the daytime, he wrote plays at night. Like Kleist, he was dissatisfied with his own work, and was constantly in despair. In 1817 he won fame suddenly by writing *Die Ahnfrau* (The Ancestress). This was followed by two more plays, Sappho, and *Das Goldne Vliess* (The Golden Fleece). The stories of these dramas were taken from the Greek. No doubt you have read the story of Jason and the Golden Fleece in your mythology.

After this he wrote two plays, not often read at present, but of interest in 1825 because they were taken from Austro-Hungarian history, namely *König Ottokars Glück und Ende* (King Ottokar's Fortune and End), and *Ein treuer Diener seines Herrn* (A Faithful Servant). The drama which is considered Grillparzer's best work is *Des Meeres und der Liebe Wellen* (The Wave of the Sea and of Love), written in 1831. This is a dramatization of the Greek story of Hero and Leander. The author spent ten years writing and rewriting this tragedy. He died in 1872.

We shall next consider a writer who, although he led a comparatively uneventful life, is the author of a well-known work. Karl Leberecht Immermann, dramatist and novelist, was born April 24, 1796, at Magdeburg. Like his father, Immermann held a minor official position and consequently he was compelled to divide his time between literary work and the official duties. In 1815 he fought in the battle of Waterloo and also marched into Paris with General Blücher.

IMMERMANN, WHO WROTE MÜNCHHAUSEN

We hear of Immermann chiefly because of his great satirical novel Münchhausen. In this book the author attempted to portray all the follies of the times. This novel is often called

Franz Grillparzer.

a "romance of humbuggery." Each one of the important characters is the victim of certain illusions, or, in other words, believes that he can do and has done impossible things. Very often, even at the present time, when a person doubts another's word he is apt to say: "You are just like Münchhausen." Immermann died in 1840, after having written two other tales—Merlin and *Die Epigonen* (The Epigoni)—and several plays. He also managed a theatre at Düsseldorf for some time, but it was not successful.

It is difficult in a short space even to hint at the marvelous life of Johann Wolfgang von Goethe. He lived from 1749 to 1832. He was almost everything a man can be. By disposition as variable and uncertain as the proverbial weathercock, he made himself a great poet, a great dramatist, a great novelist and a man of science. He was also something of a statesman and a courtier, and yet was a lover of simple people and a collector of folk-tunes. At one moment he was so sentimental that the tears ran down his cheeks; at the next, he was a hardened cynic, laughing at all emotion, particularly his own. His sins were many; his religion was deep, earnest and noble.

He said of a poet who might have been a great man that he failed "to tame himself." His own life was a magnificent effort in that direction. Born of well-to-do and cultured parents, living in an atmosphere of refinement and goodness, catching notions of dandyism from an occupation of his town by French troops, Goethe learned from Herder that the wild and the passionate are the true field of genius, and he flung himself into the ancient northern legends (the sagas) with all the force of his highly emotional nature.

THE REMARKABLE CONTRASTS IN THE GREAT WORKS OF GOETHE

He passed through this period of "storm and stress" to learn also from Herder the nobler lesson that life is a "training of mankind for humanity." At one moment we find him bringing wild charges against civilization, and declaiming with wonderful power about the satisfactions of nature, borrowing from Rousseau a philosophy which deceives many but which has never been able to work. At another moment we find him settling down like a deep ocean after an angry storm to sound the grander note of inward peace.

Some of his earlier books are to many of us so foolish and grotesque in their sentimentality that they make us laugh. It is difficult to believe that any rational mind could read *Werther's Leiden* (The Sorrows of Werther) without smiles; yet Goethe grew out of this foolishness, as he grew out of foppishness and dandyism, and grew into a wisdom as high as Plato's and a seriousness as manly as Carlyle's. He saw the grandeur of the universe and the solemnity of creative evolution, and he concentrated all his powers on solving the riddle of how mankind can be improved.

In those days men were asking themselves the question, How shall a man save his soul? Some said, By accepting the pope as the Vicar of Christ; others said, By believing the teachings of the Calvinists; others said, By not worrying the

Karl Leberecht Immermann.

mind with matters beyond human comprehension. Goethe's answer was different from all these, and his answer is the soul of all his teaching. It is that a man saves his soul by *striving*.

THE GOOD AND BEAUTIFUL THINGS THAT BELONG TO GOD ALONE

This is the central teaching of Goethe's immortal drama Faust. Faust makes a compact with Satan: If Satan can so satisfy Faust that he asks for nothing more, Satan shall have Faust's soul for all eternity.

Satan restores Faust to youth and gives him everything he desires. Faust goes from desire to desire, ever seeking the satisfaction of his soul, but never crying, "Hold: enough!" In spite of his sins he is saved, because he strives after the good, the beautiful and the true. Satan can show him only aspects of these things, never the things in themselves, for they belong to God. The soul of existence is the moral struggle.

Goethe is perhaps the only spirit in German literature which seems endowed with what we should call "Shakespearean calm." He wrote slowly and deliberately. There was something majestic about him.

© Underwood & Underwood.

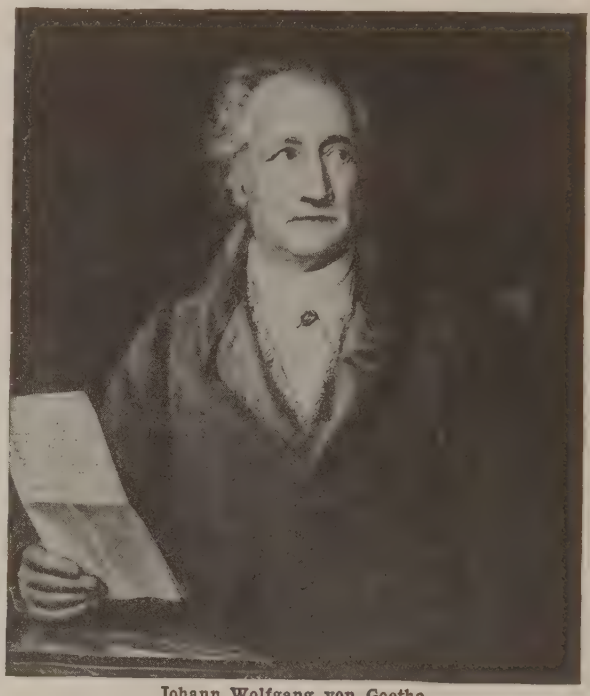
The house where Goethe lived at Weimar is now visited by thousands.

For many years he wrote no poetry worth speaking of, calmly and quietly devoting himself to the pursuit of science. He had nothing of the furious energy of Lessing, and little of the passionate zeal of Schiller. He seems to us, after his fervent youth, to have seated himself in some quiet corner of the universe and devoted all his attention to considering the work of God in nature and in man's soul. His last words were, "Light, more

Light"; and it is clear to us that all the noblest years of his manhood were spent in seeking that Light which never was on sea or land, but which lighteth every man's soul across the darkness and mystery of human life. Goethe's greatest glory is that he grew out of childish foppishness and sentimental egoism into the full stature of a mighty prophet.

THE POET SCHILLER AND HIS PLAYS OF HUMAN LIBERTY

Johann Christoph Friedrich von Schiller was the son of an army surgeon, and was born in Württemberg on November 10, 1795. He became a surgeon to a Württemberg regiment, but early began the writing of plays, and had one produced in 1782. The Duke of Württemberg acted very tyrannically toward him, and prohibited him from writing other plays, as those petty dukes of Germany were able to do at that time. So Schiller fled from the duchy and wrote his plays elsewhere, and finally found himself at Weimar. His works have earned for him the position of the foremost dramatic poet of Germany, and perhaps his play that is best known to readers of English is *Wilhelm Tell*.



Johann Wolfgang von Goethe.

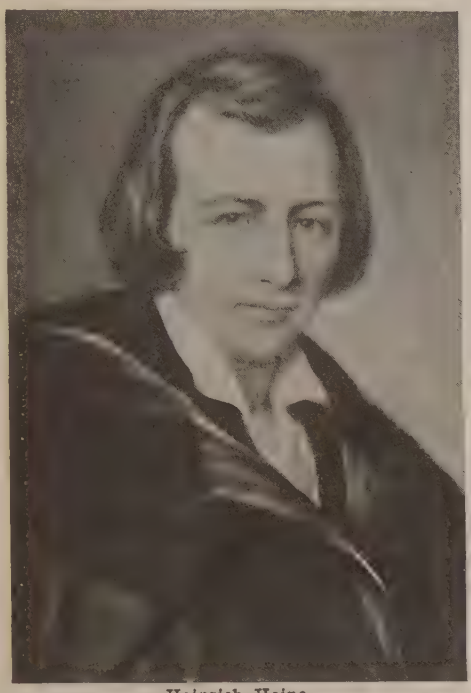
Numerous versions of his poetry are to be found in English, just as with Goethe, and his biography has been written by many authors. The most famous life is by Thomas Carlyle. Schiller's life was a long struggle against poverty. He died at Weimar on May 9, 1805.

His play *Die Räuber* (The Robbers) astonished the world. It almost idealized crime in its protest against the commercialism of the age. He wanted to bring back the heroic men he found in Plutarch, and to revive the warrior-souls of German folk-songs. "The age seemed to him," says Dr. Calvin Thomas, "a pusillanimous, servile, cringing, babbling, inkspatting age, the social order of conspiracy against all towering manhood."

He never found the peace that Goethe found, and never wholly lost the effect of rhetoric on his soul. But as he advanced in years, suffering and an invalid, he saw nobler things in liberty than he had first imagined, and in his great play *Wilhelm Tell* we feel that he has a right to be called the "poet of human liberty," so high and clear and true rings out his challenge to all the forms of tyranny, so entirely does he associate himself with the patriotism of a people rightly struggling to be free. The friendship between Goethe and Schiller is a pleasant page in the history of German literature.

HEINRICH HEINE

The life of Heinrich Heine is one of the most interesting of any of the great German writers. He was born in Düsseldorf on Rhine in 1797. When about eighteen years old he went into business with his uncle, a wealthy banker of Hamburg. Here he fell desperately in love with his cousin Amalie Heine, but she did not love him. Love is the subject of many of the writer's most famous poems. His uncle, having great faith in the boy, decided to establish him in business; unfortunately, in six months Heine failed. Heine was born a Jew, but because of the prejudice against the race in Germany at that time he changed his religion, not because he admired the Christian faith, but because he believed that a



Heinrich Heine.

Jew could never receive the proper recognition. This fact had a great influence upon the man's life, because it naturally follows that a man who did not have the courage and strength to adhere to his religion could not have been sincere in his writings. His whole career was poisoned because he could not live according to his ideals.

The poet went to Bonn to study law, and then to the University of Göttingen, where he was suspended because he was found engaging in a duel. From Göttingen he went to Berlin, and upon his arrival there was told that Amalie Heine had married. This further helped to unsettle his morbid, ill-regulated mind. He obtained money from his uncle and went to Cuxhaven, on the North Sea, where he wrote many of his best sea poems.

Later he returned to the university, and afterward lived in Munich and Berlin. His *Reisebilder,* or Travel Pictures, brought him fame, but he decided to go to Paris to live in 1831. There he married an ignorant girl whom he loved very much until his death, in 1856. The last years of his life were passed in horrible suffering from an incurable disease.

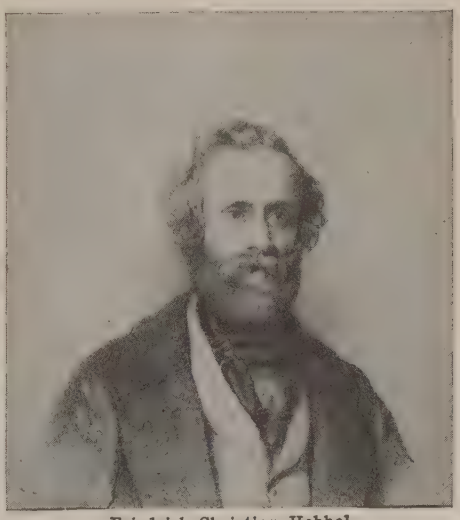
Although Heine wrote plays and essays, his best writings were in verse form. The poem whose first line is "A pine tree stands deserted," is nothing more nor less than a portrayal of the author.

The poet's most famous works are *Buch der Lieder* (Book of Songs) and *Reisebilder* (Travel Pictures). Some of Heine's lyrics may be found in the Book of Poetry. After reading Lorelei, Pretty Fisher Maiden, and To My Sister you will understand why such a well-known composer as Franz Schubert has written music for them. They flow like music already.

TWO AFFECTIONATE BROTHERS WHO WORKED TOGETHER

On page 3194 we told of the fairy tales collected by the brothers Grimm, but these were not their main work. Both were learned professors who studied not only the German language but all languages, and the habits, manners and beliefs of ancient peoples.

Jakob Ludwig Karl Grimm, the elder, was born at Hanau in 1785, and his brother, Wilhelm Karl, a year later. Both were educated at the University of Marburg, and then were separated for a few years. Jakob studied in Paris, and was in the employ of the government of Hesse for many years, while Wilhelm was a librarian. Both of them were invited to become professors at the University of Göttingen, but they objected when the king of Hanover took back the constitution he had given the state, and were banished. In 1840 they were invited to come to Berlin, and lived there until they died, Wilhelm in 1859, and Jakob in 1863.



Friedrich Christian Hebbel.

Johann Christoph Friedrich von Schiller.

FRIEDRICH CHRISTIAN HEBBEL, DRAMATIST

Friedrich Christian Hebbel, the son of a poor bricklayer, was born at Wesselburen, March 18, 1813. His early life was a hard struggle, because his family could not understand why the boy wished to enter upon a literary career. They believed a position in a business, or a profession where more money could be made, would be better. While at school Hebbel sent some verses to a newspaper. A popular journalist at that period, Amalie Schoppe, discovered these poems and made it possible for the young man to secure an education. He was not grateful and took it for granted that people ought to be glad to help him. After leaving the university he appealed for help to a friend, Elise Lensing. The young girl sacrificed much to aid him, and Hebbel, as soon as be became famous, forgot the girl and what she had done for him.

In 1839 his verse-tragedy Judith attracted the attention of a Berlin actress, who successfully acted the title rôle and started Hebbel on the road to success. Soon after his prosperity began the writer received from the king of Denmark a traveling scholarship which enabled him to spend some time in France and Italy. At that time the duchy of Holstein, in which he was born, belonged to Denmark, though it later became a part of Prussia. After returning home from his travels he settled in Vienna, where he married a wealthy actress.

Among Hebbel's early plays are *Maria Magdalene* (Mary Magdalen), *Herodes und Mariamne,* and *Gyges und sein Ring* (Gyges and His Ring). The last-named, generally considered his masterpiece, is an excellent example of his dramatic genius.

Hebbel died in 1863. The last seven years of his life were devoted to the play The Nibelungs, which has been made famous by the immortal composer Richard Wagner.

There is a writer whom some students of German literature consider as great as many of those we have already mentioned. This is Gustav Freytag, a busy editor who also wrote novels, plays and essays. He was born at Kreuzberg, Silesia, in 1816, and studied at the University of Breslau, and then at Berlin. For a little while he lectured on German literature at Breslau, but he was not happy teaching and went to Leipzig to become an editor. The first work which attracted attention was a play, *Die Journalisten* (The Journalists), published in 1853. It is still acted, and is often read by pupils studying the German language in our schools. Two years later *Soll und Haben* (Debit and Credit), his greatest novel, was published. He also wrote critical and historical essays, was elected to the North German legislature, and accompanied the crown prince of Prussia in the Franco-

Jakob Ludwig Karl Grimm.

Gustav Freytag.

Prussian War. After this he wrote six novels intended to be a sort of history of the German people, and also did much writing for a weekly paper. He died in 1895, having had a long and busy life.

In Herder, Schiller and Goethe we may behold the gentle side of our Aryan forefathers at strife with the warlike passion of those Aryan descendants who sang of heroic men and overthrew the Roman Empire; and this strife was revived again in a colder and more deadly spirit in the age of Bismarck. Men in Germany were still reading Goethe, and still studying the great German philosophers Kant, Hegel and Fichte—about whose immortal writings we cannot speak in this place—when the Prussian armies began to march, and the scattered German provinces became a single empire under a kaiser. Up till that time the Germans were known as a gentle, music-loving, deep-thinking and modest people who devoted themselves to a simple manner of living, and were famous for their beautiful home life, their love of their children, and their happy way of keeping Christmas—an awkward, uncouth and almost rustic people, very lovable to those who knew them well, and trustworthy in all their engagements.

THE NATION THAT FORGOT THE TEACHING OF HER GREATEST SON

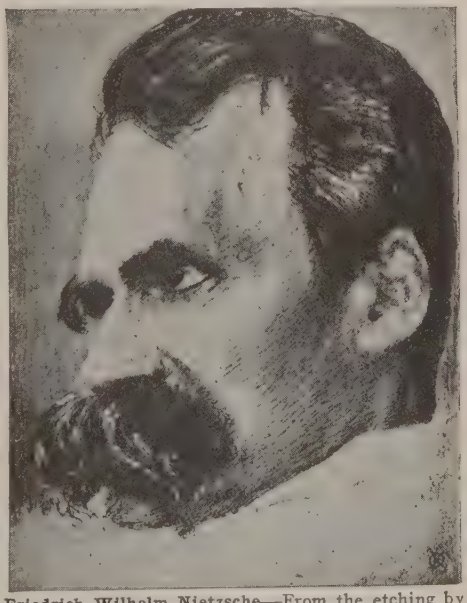
But with the military victories of Bismarck, and the rise of Germany as a power able to annihilate the armies of France, a change appeared in the journalism and literature of the nation. It was a return to the past. It was a revival of barbarism. From 1870 onward the pure literature of Germany becomes contemptible. In science, in philosophy and in historical criticism the Germans held their proud position of eminence, but in prose and poetry they sank out of sight in European culture.

One figure of interest emerges from that sea of mediocrity. It is the figure of Nietzsche, who hated the Germans as Heine did, yet spent his days in urging them to be supermen, or warriors of the ancient days. A writer called Treitschke sounded the same dangerous note, plainly and blatantly and with no confusing imagery such as Nietzsche used; and the obedient Germans, responding to that note and forgetting Goethe, became the most offensive people in Europe. The World War—in which for the first time they fought against England—the dismemberment of the German Empire, and the destruction of the monarchy, brought an end to that painful period of their history; and it is now believed that the best minds in Germany are turning back to Goethe for guidance and consolation in the dark and fateful hour of their downfall.

THE GERMAN PEOPLE AND THE GREAT BATTLE OF THE SOUL

Those who read these words will be able to follow the movements of German literature during the next fifty years. Let them realize that in the heart of every German there is a love of peace and a fear of peace, and that this great battle of the human soul has not yet been fought out.

THE NEXT STORY OF LITERATURE IS ON PAGE 6559.



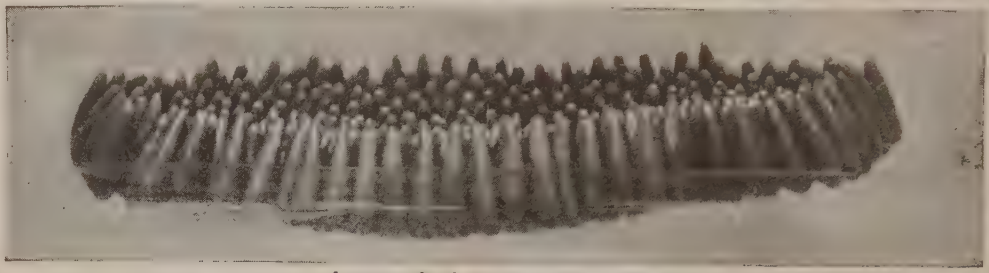
Friedrich Wilhelm Nietzsche—From the etching by Hans Olde.

A SWARM OF FLIES

Warble-fly.

Hessian-fly.

Sheep ked, a wingless fly.



An egg raft of the common mosquito.

Bluebottle-fly.

Girdled drone-fly.

Noontide-fly.

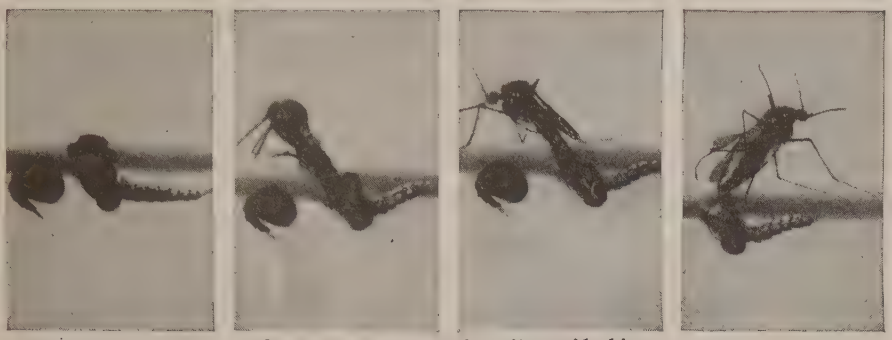
The hover-fly grub, the fly, and a hover-fly just emerged from its chrysalis.

Horse bot-fly.

Spotted mosquito chrysalis.

Nasal bot-fly.

The pictures on these pages are by Mrs. M. H. Crawford, Messrs. Collins, Ward and others.



A mosquito emerging from its pupal skin.

MOSQUITOES AND FLIES

CONTINUED FROM 6358

Colorado Beetle.

PEOPLE often ask why such pests as flies and mosquitoes were made. Nature never apologizes, is never penitent, never pitiful to the incompetent. Her ancient plan was to endow various Orders in various ways. She has expended the nicest care over the equipment of a mosquito which carries the seeds of death into human blood, but she has fostered in the human skull a brain which, rightly directed, enables us to avert this peril that flies by night.

Not all Mosquitoes are deadly. We have many species which inject a mild poison into our blood to inflame but not to destroy. The mosquito which does kill is only the means, not the cause. It is itself the victim of a parasite, and that parasite is the instrument of destruction.

The insects which we fear most are harmful, but by attention to hygiene and by the employment of proper means, we can make our lives secure at home; and little by little, as civilization advances, we can carry the same methods into the wilds and make them also safe for human life.

Ice and snow, chilling rains, and bitter winds were in the world when we came into it. Fire and flood, raging torrents, and deep, swift seas were there to burn or drown us. Our ancestors learned to control or to manage these lawless forces and reduce them to our service. The insect problem is no more difficult. We can seek out the death-dealing mosquito and defy its ravages. We can even make the malarial enemy bite to our advantage. For we are told that inoculation, in a mild form, by the malaria-carrying mosquito is beneficial in general paralysis of the insane.

Not all mosquitoes are ministers of death. Unless they are themselves infected they cannot transmit disease to us. The germs of malaria and of yellow fever, of which mosquitoes are the carriers, are parasites which pass one stage of their lives in the blood and stomach of the mosquito and the other stage in the blood of man or other mammal.

We cannot suppose that mosquitoes thrive on their infection. They would be better without it. They themselves are victims, and victimize us in turn. As a fact, we have more than one species of the Anopheles mosquitoes, the malarial ones, in our country, but they are entirely harmless, save for their irritating bites, unless a person or animal affected with malaria chances to be bitten by them.

If that happens, the parasite passes from the blood of the man into the body of the mosquito, multiplies there, and is passed on into the system of the next person bitten. That man thus be-

comes a carrier of the affliction and can infect numerous other mosquitoes. All of them, when they drink their succeeding meals of blood from new human victims, continue to spread the disease.

A NEW DANGER BROUGHT BY MEN FROM THE WORLD WAR

There lies the danger for us. Since the World War many men have brought home the organism of malaria in their blood. These men, visited by the Anopheles mosquitoes, pass on their living poison to the insects, and set up new waves of danger for the rest of us.

Years must pass before the danger is over. It has been conquered in the past and will be again. We read hundreds of references to ague in the history of our beautiful land. That ague was malaria. Almost unconsciously in many sections we defeated the dreadful malady by the cultivation of the soil. We drained bog and marsh, and turned them into fields and gardens and towns. At each increase of such reclaimed lands we dried up the source of the mosquito life.

Malaria itself tells the tale of the old belief as to the disease which it describes. Men thought that marsh air was bad to breathe and that it was this air which brought malaria. The word malaria means simply "bad air"; as a fact, however, air had nothing to do with the matter.

CLEANLINESS AS THE GREAT ENEMY OF DISEASE

It was the water, the marshes, the sodden banks of rivers and lakes, the puddles and muddy pools of filthy cities and villages, that were the breeding-places of the fatal mosquitoes. Malaria and mosquitoes vanished together from a district when cleanliness took the place of neglect and bog was converted into dry land. Apparently the supply of malarial parasites died out in many parts of our country. There are many districts where no malaria has been known for a long time. The mosquitoes living there are innocent of harm if uninfected from external sources. Though harmless, they are as irritating as the black midges which torment us with their poisoned bites on the damp tennis court and on the rivers.

The tracking-down of the germs of malaria and yellow fever is a triumph of our own time, and we tell the story on page 5488. The building of the Panama Canal was one of the greatest engineering achievements the world has seen. The conquest of the little mosquito which had so long kept it back was a performance of even greater importance. That conquest has its effect in every tropical land to which civilization spreads. Beat the mosquito by cleanliness and common prudence, and the tropics become health resorts, where formerly a white man was doomed.

What did the mosquitoes do for their blood supply before man appeared in America? They lived, we suppose, on vegetable juices. The deduction is based on the fact that mosquitoes deadly to man and animals teem in billions in great areas of the world where man has never yet established himself, and where big mammals have not gained a foothold.

INSECTS WHICH SEEM TO HAVE TAKEN THE WRONG TURNING

If the dreaded mosquitoes are vegetarians there to-day, they must always have been. It is reasonable to assume that the same rule governed the appetite of the ancient mosquito. Another line of inquiry has led science to the belief that the bacteria now so deadly to other forms of life were once equally harmless, and lived lives of innocence.

If this is true, then how foolish it is to blame Nature for her insect children. They do harm, but they are simply fresh examples of groups of life which have taken what seems to us the wrong turning. They are like the kea parrot, which has become a murderer of sheep, and the gull, which has turned inland from the stormy sea to garner into its crop the grain that man hoped to harvest for himself.

This great Order of two-winged insects, the Diptera, as they are called, includes the mosquitoes, midges and the rest. A stride from the mosquito, and we are among those long, brown-bodied flies with straggling limbs—flies which we call Daddy-long-legs or Crane-flies.

They look like mosquitoes as we might see a mosquito under a magnifying lens, but they have none of the sawing and piercing implements of the smaller and more formidable insect. Their mouth parts are framed only for the harmless occupation of sucking up surface moisture. The adult crane-flies are harmless, though the spear-like projection at the rear of the female's body looks like a sting. It is, in fact, only a marvelous

contrivance with which she bores, and through which descend the eggs she deposits in the ground.

The mosquito larva is hatched in water and is harmless there; but the baby of daddy-long-legs is hatched in the earth, in the lawns, the pastures, the flower borders. And this does mischief enough to grass, the roots of flowers, and so on, to make up for all the engaging helplessness of the swarming adults drifting in brown clouds in the air of a summer night.

That we are plagued by these leather-jackets, as the larvæ are called, is one of the penalties we pay for the indiscriminate slaughter of birds that hunt them.

THE TERRIBLE PROCESSION OF WORMS WHICH EAT THE GROWING CROPS

We cannot always trace cause to effect in the multiplication of our insect foes, as, for example, when enormous hosts of the Army Worm appear and devour pasture and corn like a moving fire. But as corn cannot be damaged save where man has sown it, we may be right in assuming that the hand which scattered the grain scattered also the natural foes of the army worm which eats the crop.

The parent of this army worm is a small black fly which lays some hundred eggs in the earth, and should not be confused with a moth whose caterpillars are also called army worms. The larva is a maggot and is about a quarter of an inch long. Normally little groups keep to themselves, but in the years when numbers are enormous, swarms meet swarms. The innumerable larvæ form themselves into long columns and march as an army. When one part of the line halts the others crawl above it, and the sinuous mass winds its slow length along, feeding, fattening, clearing all before it like locusts.

Perhaps because supplies grow short, perhaps because they have lived long enough in the larval form, the great mass contracts, thickens, becomes an enormous ball. Then it disappears slowly into the earth. Much mystery is made of this sinking into the ground, but there is no mystery. The army worms at the bottom of the pile excavate and sink the whole mass of life, as a burying beetle sinks the dead bird or mouse on which it intends to live. Though the name is applied to quite different larvæ in different parts of the country, the habits of all are similar.

A NATURAL EXPLANATION OF AN APPARENT MYSTERY

The plain reason for this tunneling and disappearance is that their hour for change into the pupal state has arrived. The larvæ know it as well as a caterpillar knows when it must spin its cocoon and change.

Leaving the army worms to their crawling, we glance into the air to espy the hateful little Midges. They bite and cause intense irritation to all, and genuine illness to some people who are susceptible to their not-very-terrible venom. We do not have to see them: a good ear catches the high note of their wings and humming as they fly. They are not mosquitoes, though closely related to them; and their bite is never fatal. It is inflicted by lancet and saw, after which a fluid is injected by the insect to render the blood thinner and capable of being drawn up. The effect of mosquito and midge is much the same on us in its irritation. Only the mosquito can carry the germ of fever. However, the midge-bite, when administered by a swarm of insects, can drive away sleep and happiness from all but those fortunate people whose blood is not affected by the little drop of virus.

HOW THE PLUMED MIDGES PAY FOR THEIR FIERY SPLENDOR

Midges, which are among the minor inflictions of summer life in the open, have their troubles not less grave than those they inflict. Enormous swarms of plumed midges have been observed in Russian Asia to be apparently on fire with splendor, luminous and lovely. But this phosphorescent brilliance seems to be the product of harmful bacteria which so enfeeble the victim that it is reduced to crawling and is completely deprived of the power of flight.

Now, can we suppose that such a condition can become habitual and harmless in a group? It would almost appear so. Among the fungus midges two or three genera are known in which the power to light a lamp in the living body is accompanied by no more hurt than in the glow-worm. In Europe there is the *Ceroplatus sesiosides*, and in New Zealand, where it is called the glow-worm, the *Boletophila luminosa;* both put forth an astonishing radiance, but to what end we cannot yet say.

To us only the beauty appears, but the

larvæ possess the radiance as well as their parents, and employ it as a lure to tempt prey to their gummy webs. There seems to be some purpose in it similar to that which lights the lanterns of the deep-sea octopus and those of the great-jawed hungry fishes of the ocean abysses.

THE FILTHY CONDITIONS IN WHICH THE FLIES COME INTO LIFE

There is not much mystery remaining for us in the life-story of the Flies which haunt our homes, unless it be the mystery as to why we tolerate them. The flies which infest our homes are not born there, but are cradled in corruption and horror, in dunghills, in deadly disease-breeding dumps.

It is there that the adult female lays her eggs, there that the eggs hatch into the maggots which fishermen use as bait. Egg, larva and pupa stage are all passed in these horrible surroundings. The fly bursts from its pupal case and has to crawl through filth to the daylight. Its feet and its hairy body bring with them crowds of deadly microbes. They come into the house, straight to the food and milk, to foul them, to cause fatal illness to babies, and sickness, and possibly eventual death, to adults.

Most of the abominations which used to poison the food of our ancestors and make their lives melancholy and brief have been swept away by modern sanitation. The fly, deadly as any, is still endured through ignorance or indifference.

WHY WE MUST ALWAYS KEEP FOOD AWAY FROM FLIES

Distinguished scientists have had the patience to work out the life-history of the fly. The task is quite as important as the expeditions to the tropics to study deadly creatures there. These scientists tell a terrible tale of this common foe of our domestic peace and comfort.

The fly carries living corruption about its body; it carries corruption in the food which it has eaten, and when it meets a more attractive diet it throws up this poison on the fresh food in order to fill itself with the more pleasing foods. Especially is this the case when it finds a supply of milk. Into it goes the poison which every September, the great fly month of the year, slays infants wholesale.

The House-fly keeps the germs of typhoid alive in its body for twenty-eight days, and for another twenty-three days after this deadly parasite leaves the body of the insect it retains its life and virulence. In addition, the fly brings into our homes cholera, dysentery and other diseases of the intestines. It causes ophthalmia, that loathsome affection which mars the beauty and use of myriads of bright eyes in the East. It is possible that the germs of tuberculosis also find a carrier in the fly.

Yet this slayer of our children and poisoner of our adults is tolerated by many people who should know better. The refuse heaps in which it breeds are permitted to remain uncovered and untreated, at the cost of many little human lives every year.

THE SMALL BLACK HOUSE-FLY WHICH DRAWS ITS VICTIM'S BLOOD

We have more than one species of house-fly. The majority merely moisten and suck; but the little Black House-flies draw blood. These are not undersized members of the ordinary fly tribe, but fully developed examples of their kind; for flies are full-sized at birth and never grow after quitting the chrysalis form. Care and cleanliness will some day banish the fly from our houses, but till then we have a possible carrier of death or violent illness in every one that alights on our food.

But all the flies are a problem. There is the Bluebottle, which we rather admire because of its breezy, tempestuous dash and hum. Yet it is a horrid creature. It deposits eggs not merely on meat, but on living flesh, on open wounds, even in the nostrils of sleeping infants and invalids. Civilization ought not to endure this little monster.

But there are worse flies than ours, as any Italian will tell us who, with natives of other warm countries, has had experience of the Sand-fly. It is a minute fly, difficult to discover; but, now that it is known to inject into its victim the bacilli from which pellagra arises, it is one of the most dreaded of insects.

Pellagra is a terrible source of suffering to human beings, ending after many years in madness and miserable death. Who will rid the world of sand-flies? Within the last two years this insect has been proved even more frightful than was supposed. We had all imagined that the sand-fly, like the mosquito, must be individually infected by bacteria, of the

parasites of which it is the host, before it could cause pellagra in a human being.

Scientists have made the dismal discovery, however, that a sand-fly is born with an inheritance of infection. Sand-flies bred from eggs brought with great care to London and reared in scrupulously sterilized conditions have been permitted to bite volunteer students, and have set up the malady in them for which the breed is infamous. Thus the risk of the spread of pellagra is lamentably greater than any of us had dreamed, possibly not in the North, but in warmer lands to the South.

With ways less terrible to ourselves, but dreadful to animals, there are many flies which keep to the open air. Among these are various Bot-flies. One of these, *Gastrophilus equi,* is a plague to horse life. Irritated by the attentions of the fly, the horse licks itself and transfers the larvæ to its mouth, whence they are swallowed. The larvæ hook themselves to the stomach or intestines of the horse and there complete their larval growth.

Grubs of the house-fly.

The house-fly.

Pupæ of the house-fly.

The grub and pupa of the blue-bottle-fly.

Larvæ of the pear midge inside a pear.

The maggot, pupa and empty pupa-case of the apple maggot.

The daddy-long-legs, or crane-fly.

The grub and pupa-case of the crane-fly.

British wheat midge, adult specimen.

THE WARBLE-FLY AND THE DISCOMFORT IT CAUSES TO CATTLE

We do not know that the process does the horse very much harm, but it must

cause discomfort. There is unfortunately less doubt as to the Warble-fly, which cattle fear as we fear angered hornets. In the blazing heat of a summer afternoon, when the cattle should be chewing the cud in the shade of the trees, we sometimes see them madly rushing about their pastures. The cattle are clumsily seeking to flee from a dreaded enemy.

The fly deposits its eggs on the hide of the animal. There these hatch for the maggots to eat their way into the flesh and cause hideous wounds beneath the skin. As many as four hundred of these gnawing parasites have been found beneath the hide of a single cow. The poor animal is miserable; it loses flesh, and its milk is insufficient and inferior. When the end comes, and its hide is to be converted into leather, immense damage is found to have been caused. The leather trade suffers from this cause a loss of millions of dollars a year, to say nothing of the sufferings that the unfortunate cattle have to endure.

THE DELIBERATE PERSECUTION PRACTICED BY THE FOREST-FLIES

The so-called Sheep Bot-fly is another horror. It penetrates the flesh of the sheep's nose with disastrous effect. But the name of this fly is too restricted in its implication, for the insect attacks man, birds, frogs, toads and other amphibians.

We have noted the love of cattle for shade, a passion which horses share; but there are winged enemies for them there too. There are several species of strange Forest-flies. A more deliberate career of persecution than that of the forest-flies could not be imagined. They attack horses, cattle, deer, and even birds. Beginning as winged couriers, they break off their wings when they alight on their prey, just as queen ants break off theirs after their marriage flight. Then these flies settle down to drink blood drawn from those parts of the flesh least protected by hair.

There are more terrible forest-flies than these, however—the Tsetse-flies which haunt the forests deeply fringing the great waterways of Africa. There are many species of tsetse-flies, some harmful to domestic animals and not to man, others as terrible enemies as human beings have to confront.

These flies are parasitic on the great game of the Dark Continent. They are able to take their blood supply from animals with tough hides, such as antelopes and zebras. They are furnished with piercing and sucking implements, though in themselves they generally resemble in size and outline our own blow-flies.

THE BARRIER OF FLIES THAT KEEPS THE STRANGER OUT

Now, in the blood of the game which these flies attack swarm myriads of low organisms, eel-like in outline, called *trypanosomes*. They undergo one stage of their growth in the original host, and are then sucked up in the blood drawn by the fly. They remain dormant in the interior of the insect and renew growth and attain maturity in the body of the mammal which the tsetse next bites.

The range of the tsetses is widespread, but not continuous. They abound in what are known as fly belts, areas of great size which have their definite beginnings and endings. Into these belts no domestic animal can penetrate and live. The fly injects its poisonous parasites into horse, ox, donkey, dog, and these sicken and die a horrible death. That disease, peculiar to animals, is called nagana, and cannot develop in human blood.

That is a hindrance to colonization in the fly-infested country, for man is entirely dependent on animal service in such conditions. But it is from the tsetse-fly that that dread malady, sleeping-sickness, is carried to men. The name conveys the character of the ailment, and is not, of course, that of which we hear in the North under the name of sleepy sickness.

The real sleeping-sickness is as fatal to white men as nagana is to white men's animals. It is as terrible in its course, as deadly in its issue. Natives whose ancestry has for generations lived among tsetse-flies are as immune as zebras and lions are to nagana. When new areas are opened up between tsetse country and non-tsetse country the flies advance through the cleared ways and produce frightful havoc among the non-immune natives.

HOW THE RAILWAYS IN AFRICA HAVE HELPED TO SPREAD DISEASE

Possibly no malady has run through Africa with such frightful rapidity as sleeping-sickness. Railways during our

own lifetime have created long corridors through forest land along which the disease could be carried. There have been times when the black sons of Africa have died from sudden onslaughts of sleeping-sickness by the hundred thousand. That is what a puny fly, to whose attacks man is unaccustomed, can do for humanity.

Flies of many species have yet to be studied, and there are a host already described for the student who can seek their story in science textbooks; but we may repeat that not all the flies among us are harmful. The Bee-flies are a boon to us. The adults restrict themselves to the nectar of flowers which they help to fertilize, but their larvæ are great devourers of caterpillars and of ground insects which harm our crops. The Drone-fly's larvæ eat decaying vegetation which makes wayside waters unpleasant, and also consume carrion when the eggs are laid in the carcass of a dead animal.

The Bumblebee Flies closely resemble the bees after which they are named, but they puzzle us. Some place their eggs in the nests of honeybees, some in those of wasps. It is not certain whether the larvæ eat the young of the bees and wasps or whether they merely act as scavengers and consume waste matter. The second idea seems the more probable. We cannot imagine that creatures so wise as bees and wasps would sanction the presence of slaughterers of their larvæ.

A USEFUL LITTLE ALLY AND ITS FINE POWER OF FLIGHT

We are on more certain ground with the Hover-flies, and can welcome them with delight. As they dart and dash among our sunlit flowers, first with the speed of a dragon-fly, then pulling up short as though halted by the most marvelous of brakes, then rising straight on a level keel, next darting sideways, then backward, then down, fast as the sunbeam they follow, we see the perfection of flight, the ideal at which man aims, but has not yet attained.

More grace and enterprise in flight, greater suggestion of rapturous enjoyment, no creature shows. We welcome them for their merry grace and avidity, but we accept them as unsworn, uncontracted allies, for their larvæ grow up among the gorging plant-lice, and devour the vital juices of those hateful parasites with an appetite like that of a hungry donkey introduced to unlimited carrots.

Even if we had no plant-lice to ruin our crops we should still retain the hover-fly in our affections for its grace and beauty; but there are some flies which we value for service. There is in Northern Africa, for example, a fly as much like our house nuisance as the tsetse-fly, the *Idia fasciata*, which is worth far more than its weight in gold. It is to the devouring locust what the monitor lizard is to the crocodile: it eats the locusts' eggs.

A FLY OF NORTH AFRICA AND ITS SPLENDID WORK FOR MAN

The parent fly has no direct part in the service, except a wonderful instinct for finding where the eggs lie. She is even more determined than the ichneumon, which pierces a tree to lay her eggs, for this little fly burrows down three or more inches into the hard and burning soil to reach the place where the great powerful locust has hidden its store of eggs.

There the *Idia fasciata* lays *her* eggs, and the young ones, when hatched, live entirely on the locust eggs, which they devour in great quantities. How much they save us by this destruction of the foes of the crops is not to be estimated, but man's debt to them must be very great.

Flies in the past must have rendered great service as devourers of carrion and in the destruction of vegetation which would have rankly overgrown the earth. The parasites which they then collected did not matter to us, for we and our animals were not there to be afflicted by them. Now, however, we have overrun their ancient territory, and by our own neglect have aided in their multiplication, to our serious disadvantage.

We have taken weeds and changed them into cultivated growths valuable to human life and health. The parasites have come in with the vegetation which we have seized and improved. There is not a thing we cultivate which has not its special parasite or parasites, pests which have to be combated as anxiously as frost on summer nights.

There are flies peculiar to celery, to carrots, to onions, to apples, and so forth, all laying eggs from which maggots emerge to devour either the foliage, the fruit or the root of the growth to which their lives are committed.

PESTS OF THE COUNTRYSIDE AND HOW WE MAY DEFEAT THEM

The number of pests tends to increase, as does the number of individuals, where neglect makes multiplication easy. There is a treatment for each if we will take the trouble to apply it. A few cents may bring to any of us admirable publications prepared by the greatest living experts under the direction of the Department of Agriculture. It is our own fault if we do not meet these scourges of the fields, pasture and garden with the knowledge that may make us triumphant.

Human population is constantly growing; indeed it is slowly outgrowing food supplies, so we shall in time have to fight the insects scientifically or starve. They eat a very large part of every crop that man sows and cultivates. Soon we shall be so many that we cannot spare any of the food the ground produces. The flies are marvelous in their methods of maintaining a hold on life and of extending their sphere. There are flies which do not depend on reproducing separate generations by successive batches of eggs.

Some are born alive, devouring the body of their mother before entering the world as larvæ ready immediately to turn into chrysalises. More wonderful, we have baby flies giving birth to other baby flies. That is to say, the larvæ, without ever attaining perfect insect form, produce larvæ like themselves. The new generation of larvæ devour the old larvæ of which they are born, and they themselves, remaining babies, become parents, for they also, without growing up, evolve other larvæ from their own bodies.

FLEAS WHICH CAUSE DISCOMFORT AND DISEASE

Fleas were formerly classed with flies, and were described as flies which had lost their wings. They are now generally treated as a separate Order.

However, quite recently Dr. Karl Absolon, curator of the Brunn Museum, has found flies in the Balkan caves and underground watercourses which have lost their wings as completely as the fleas.

There are at least a hundred known species of fleas, of which a third are found in America. Fortunately the ordinary House-flea of Europe (*Pulex irritans*), which prefers to bite human beings, is not common on this continent, but those which live on our cats and dogs are unpleasant enough. Many of our animals —squirrels, foxes, rats—have special fleas of their own, which may sometimes bite humans.

At least four species of fleas which are common on rats are known to bite man. Now, the rat may be infected with that dreadful disease common in Eastern countries known as bubonic plague. It is probable that this disease, or something very much like it, was the plague, or Black Death, so common in Europe during the Middle Ages. A sick rat may board a ship in an Eastern port, bringing his fleas with him, and may leave the ship in one of our ports.

The detestable flea, which feeds on the blood of mammals of all sorts, is the demon of the plague tragedy. He carries the fatal germ that mowed down more millions of human beings in Asia and Europe during the Middle Ages than all the wars ever fought. When a plague-stricken rat dies, its fleas leap on a human being, bite him, and he dies of the plague.

NATURE'S REPROOF OF THOSE WHO DISOBEY HER LAWS

Happily our ports are so well guarded against rats that there is little likelihood of plague's gaining a firm foothold in our cities on the water. However, a few cases have appeared from time to time in some cities of the United States.

We have fleas that are almost as dangerous. Scarlet fever is always with us; the flea carries the infection. It is now believed to be the bearer also of the parasite from which rheumatic fever results. Plague, scarlet fever, rheumatic fever are the evil gifts of a man-infesting flea! If we all practiced the cleanly care due from civilized people, these deadly complaints would, if not utterly banished, be enormously reduced in numbers.

Fleas do persist; therefore we are not what we should be. Our flea-borne afflictions are a reproof and scourge from Nature. Our sins find us out; the innocent suffer for the guilty. The insects which we hold in detestation seem to be Nature's incitement to man to scorn sloth, indifference and ignorance, and to pursue cleanliness, care and decency of life as becomes the highest of God's creatures.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6525.